

R-13-'80

Studies on chironomid midges of the Tama River

Part 1. The distribution of chironomid species in a tributary
in relation to the degree of pollution with sewage water.

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Part 2. Description of 20 species of Chironominae recovered
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The National Institute for Environmental Studies

April, 1980

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Studies on chironomid midges of the Tama River*

Part 1.

**The distribution of chironomid species in a tributary
in relation to the degree of pollution with sewage water¹⁾**

**Manabu Sasa²⁾, Masayuki Yasuno²⁾, Mihoko Ito³⁾
and
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* This study was supported by Grant in Aid of Scientific Research,
Ministry of Education, Culture and Science, No. 403088.

1) Studies on chironomidae of Japan. Part 7, from NIES.

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3) Azabu Veterinary College.

INTRODUCTION

The insect family Chironomidae (Diptera) comprises large numbers of species whose larvae breed in all types of land water, and much attention has been paid recently by environmental biologists to the role played by the larvae as algae and debris eaters, and their use as biological indicators of the degree of water pollution. However, practically no significant studies have been made in Japan and neighboring regions on relationship between the chironomid species and the degree of eutrophication of lakes and rivers, mainly because of the difficulty in the taxonomy of this group of insects.

The present project was conducted as a "Special Study on Eutrophication of Land Water" of NIES, and also as a contribution to "Studies on the Effects of Human Activity on the Ecosystem of the Tama River" being conducted by Prof. Keizo Kamiyama and associates under the Special Research Grant of Environmental Sciences, Ministry of Education, Culture and Science. The study sites were selected along the Minamiasakawa River, a tributary of Tama, where Ogura (1978) and collaborators had conducted comprehensive surveys of water quality at monthly intervals for a period of over one year (see Fig. 1 and Table 2). Sample materials were collected on 17 August 1979 from the river-bed, reared in the laboratory to recover pupae and adults. Identification of chironomids was made by adult males as a rule. The results are being compiled in a series of 4 papers, (1) the distribution of Chironominae species in relation to the degree of pollution with sewage water, (2) morphological description of adults and pupae of the Chironominae species reared, (3) the distribution of chironomids other than Chironominae (mainly Orthocladiinae and Tanypodinae) in the same sample sites, and (4) their morphological description. Quantitative collection of larvae at each sample site was also conducted, and the results will be reported separately. For the results, about 40 species were recovered from these samples, and many of them were found to be new species or new records from this region, and their distribution was shown to correlate highly with the degree of pollution due to sewage water.

MATERIALS AND METHODS

As stated previously, most of the specimens studied were collected on 17 August 1979, from the river-bed of the Minamiasakawa River, at 6 stations selected at about 2 km intervals from Station No. 1, which is practically a non-polluted mountain stream, to Station No. 6, where the river runs through the downtown of Hachioji City and the water is highly eutrophic, being largely composed of untreated sewage water discharged from houses directly into the river. The pieces of stones, sands and algae collected at each station were transported to the laboratory in Tsukuba by car, and transferred into transparent plastic containers 25 cm in diameter and 12 cm in height. The containers were filled with well water to about 5 cm level and air bubbles were introduced continuously from the bottom of the containers with a compressor. The containers were further covered with nylon net and rubber band, and kept in rooms regulated at about 23 C under natural or artificial illumination. Adult chironomids which emerged from the samples were found mostly under the nylon net, or on the plastic wall,

sometimes sitting or drawn on the water surface, and were collected with a vacuum tube every day during the first two weeks, and later every 3 days as a rule. Pupal or larval exuviae were collected with forceps as much as possible. A part of larvae found in these samples were collected and mounted on slides. Emergence of adult chironomids from these samples usually continued over a period of about 2 months, and small amounts of larval food was provided during this period, usually once a week.

Methods for preservation and mounting of adult, pupal and larval specimens were the same as reported in previous papers (Sasa, 1968, 1969). For detailed examination of the morphological characteristics, wings of adults were first cut off with fine forceps and mounted dry under a narrow cover-glass, and the rest of the body parts were boiled in 10% KOH solution, washed in water and mounted in gum-chloral solution after dissection. The gum-chloral solution was prepared by dissolving 30 g of chloral hydrate and 8 g of gum arabic in a mixture of 1 ml of acetic acid glacial, 3 ml of glycerin, and 10 ml of distilled water. Part of the adults were preserved dry on triangular cards mounted on pin, or in glass vials, or in 70% alcohol. Specimens of pupae, larvae, and their exuviae were either mounted in gum-chloral, or preserved in 70% ethyl alcohol containing 10% glycerin.

Specimens were drawn by the author using Abbe's microdrawing apparatus with a compound microscope. The nomenclature of body parts and methods for standard measurements are almost the same as used in the previous papers (Sasa, 1978, 1979), and mostly followed those used by Pinder (1978) for the British Chironomidae.

RESULTS

The species and numbers of Chironominae recovered from the bottom samples collected at 5 stations of the Minamiasakawa River are as shown in Table 1. The samples collected at Station No. 4 were very poor and Chironominae species were not recovered. It is seen from this table that species No. 1, No. 2, No. 3, No. 7, No. 14 and No. 15 are found only at Station No. 1 (the uppermost part of the river), or at Stations No. 1 and No. 2, where the water is practically unpolluted. On the other hand, species No. 19 and 20 were found only at Station No. 6, where the water is most eutrophic with sewage water. Species No. 9, 10, 11, 13 and 16 were found mainly at Station No. 3, where the water showed a medium degree of eutrophication. It was interesting that Species No. 6 were found in large numbers at Station 5 only. From such a characteristic distribution pattern for each species in relation to the degree of pollution, we consider that chironomids can possibly be used as indicators of eutrophication of river waters when additional information is accumulated by repeated surveys of this and other river systems. The degree of eutrophication of the water at each station is shown in Table 2, which is quoted from a report by Ogura (1978).

Fig. 1. The Minamiasakawa River, and the sites of collection of chironomid samples

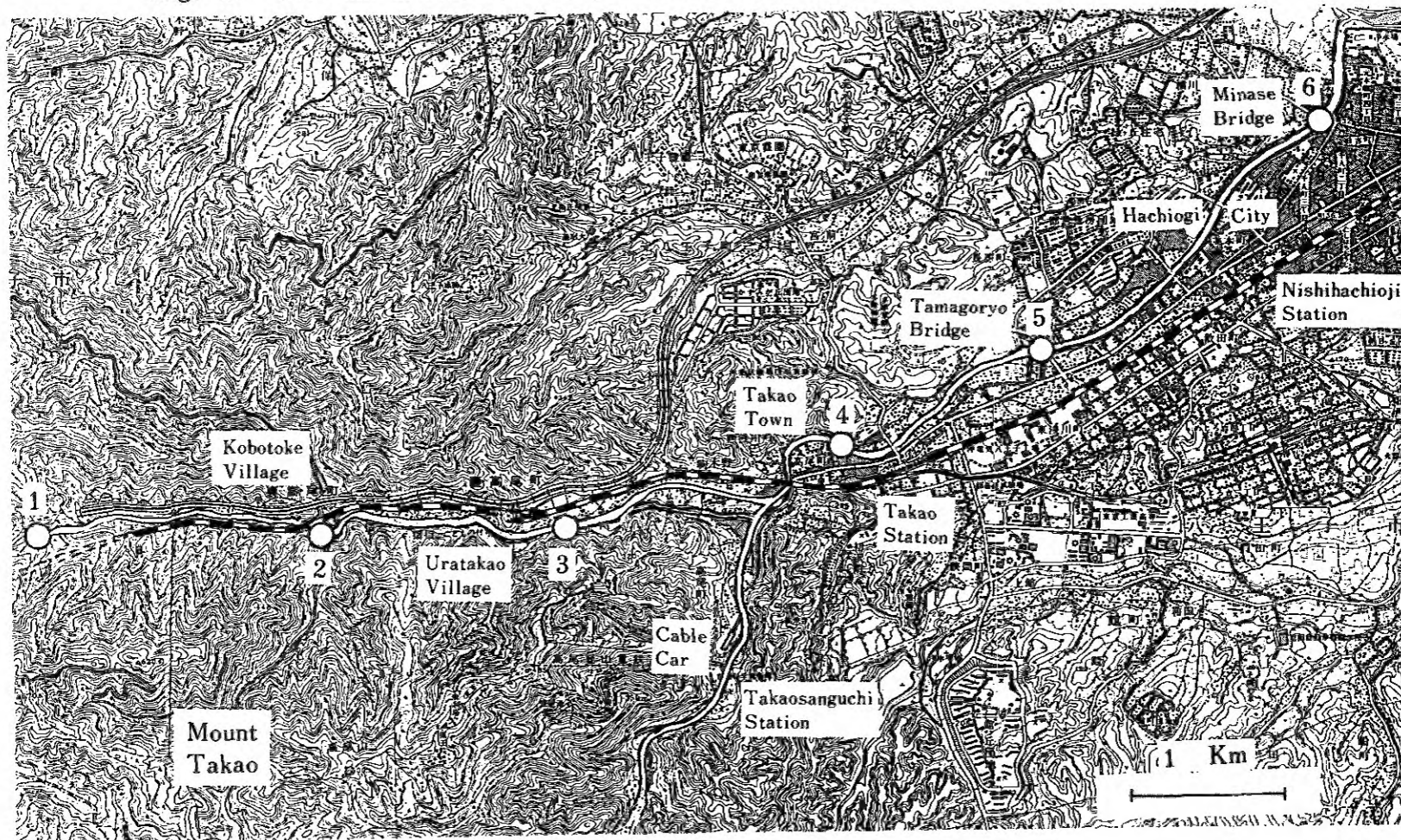


Table 1.

Numbers of adult chironomids recovered from bottom samples collected at each station of the Minamiasakawa River, August 1979. (M: male; F: female)

Species	Station of collection									
	No. 1		No. 2		No. 3		No. 5		No. 6	
	M	F	M	F	M	F	M	F	M	F
1. <i>Micropsectra tamaprira</i>	1		1	2						
2. <i>Rheotanytarsus tamasecundus</i>	3	2								
3. <i>Rheotanytarsus tamatertius</i>	2		2							
4. <i>Rheotanytarsus tamaquartus</i>			16	5						
5. <i>Rheotanytarsus tamaquintus</i>			9	7	4					
6. <i>Rheotanytarsus kyotoensis</i>							203	209		
7. <i>Tanytarsus tamaseptimus</i>	3									
8. <i>Tanytarsus tamaoctavus</i>	2				4	2				
9. <i>Tanytarsus tamanonus</i>					1					
10. <i>Tanytarsus tamadecimus</i>					1					
11. <i>Tanytarsus tamaundecimus</i>					2	1				
12. <i>Tanytarsus oyamai</i>							3			
13. <i>Microtendipes britteni</i>				1	11	17				
14. <i>Polypedilum takaoense</i>	1	1								
15. <i>Polypedilum unifascium</i>	9	3	3	2						
16. <i>Polypedilum asakawaense</i>					3	2				
17. <i>Polypedilum tamagoryoense</i>							2	1		
18. <i>Polypedilum ureshinoense</i>							3	1	16	16
19. <i>Chironomus kiiensis</i>									15	12
20. <i>Chironomus yoshimatsui</i>									55	55

Table 2.

Results of analysis of water quality at 6 stations of the Minamiasakawa River
reported by Ogura (1978)*.

Date of collection of water: 26 May 1977 (Thursday).

Station	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Time	10:50	11:25	12:05	13:10	14:45	15:20
TA °C	16.8	16.6	19.5	20.5	20.3	20.1
Tw °C	12.8	12.8	16.5	20.3	22.6	21.8
pH	6.3	6.7	6.5	8.5	7.7	7.4
EC $\mu\text{V}/\text{cm}$	66	147	170	176	384	352
DO ml/l	6.81	7.05	7.34	7.97	4.10	7.08
(%)	(91)	(95)	(107)	(125)	(67)	(114)
SS mg/l	-	-	2.9	4.9	13.5	31.5
DOC mg/l	0.51	0.48	4.22	3.67	8.33	8.50
TOC mg/l	-	-	4.80	4.50	-	10.9
T-CO ₂ -C mg/l	6.2	4.6	6.3	3.8	11.7	12.6
TP $\mu\text{g at/l}$	-	-	5.7	12.9	25.0	28.8
TDP $\mu\text{g at/l}$	0.54	0.66	4.9	12.6	22.5	22.5
RP $\mu\text{g at/l}$	0.32	0.52	3.3	8.9	14.7	16.4
NH ₄ -N $\mu\text{g at/l}$	0.0	0.0	0.0	0.0	200	222
NO ₂ -N $\mu\text{g at/l}$	0.0	0.08	0.86	5.4	10.4	11.1
NO ₃ -N $\mu\text{g at/l}$	83.5	90.0	113	86.7	62.9	67.8
SiO ₂ -si mg/l	7.2	8.3	8.0	7.3	7.5	6.1
Cl mg/l	2.9	3.2	7.9	8.9	28.6	29.2
Flux m ³ /sec	0.0011	0.0033	0.21	0.16	0.28	0.48

* Quoted from "The effects of human activity on the ecosystem of the Tama River"
(B11-R12-12, Kankyokagaku Kenkyuhokokushu), p. 37, 1978.

多摩川に発生するユスリカ類の研究

第1報 その一支流に見出されたユスリカ各種の 分布と下水による汚染度との関係

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日本産ユスリカ科の昆虫については、Sasa & Yamamoto (1977) がまとめた目録によると、これまで主として徳永雅明 (1933~1968) の研究により 169種類が記録されていた。しかし、それまでの調査は日本各地でたまたま採集された標本を同定記載したもので、雄成虫については 152種、雌成虫は 130種、サナギは36種、幼虫は31種が記録されていた。

この研究は国立公害研究所における経常研究テーマの一つとして実施され、かつその「陸水域の富栄養化に関する特別研究」の一部として将来役立ちうる可能性を考えて計画したものである。ところが、後に本文に述べるように、この水系に関するわずか1回の調査でユスリカ類の約40種の生息が確認され、その大部分が動物分類学上での新種であり、その各種の発生水域の分布が下水の混入度に応じた汚染度と密接に関連しているというおどろくべき新事実が明るみに出された。

私共のユスリカ類の分類および生態の研究は、1976年より主として筑波・霞ヶ浦地域に産する普通種の検討から開始し、Sasa (1978) は *Chironomus* 属9種の記載を行い、さらに Sasa (1979) はそれ以外の20種について成虫、サナギ、幼虫の記載をした。後者のうち12種は新種、3種は外国の既知種で日本未記録種とみなされ、日本既知種は5種にすぎず、そのうち成虫、サナギ、幼虫の各期が記録されていたものは1種にすぎなかった。これをみても、いかにわが国のユスリカ類については未知の領域が大きいかが示されている。

調査方法

今回の研究は文部省科研費「環境科学特別研究」の「多摩川研究班」(代表者 神山恵三)の研究計画に密接な関連をつけて、調査対象はこれまで小倉紀雄(1958)により水質等が詳細に報告されている南浅川の最上流から八王寺市内で北浅川と合流するまでの約10kmの間、およそ2kmおきに6か所の採集点を設定した(図1)。各地点では水底の石や水生植物などを定期的に採集、70×54cmのポリエチレン袋に入れてもちかえり、これを各サンプルごとに径25cm、高さ12cmのプラスチック水槽に移し、水を深さ約6cmに加え、エアーストーンを用いて水底より気泡を送り、上面にはナイロン布をかぶせ、人工照明ないし天然光の飼育室に約20

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℃で保存した。

このような簡易飼育装置にユスリカ類の幼虫ないしサナギを含んだ底質を保存すると成虫が羽化してナイロン布の内側ないし容器の内壁にとまっているので、これを2日ごとに吸管で捕集し、同時に水面に浮かんだり、側壁に打ちあげられたりしているサナギの脱皮殻をひろい上げ、5%フォルマリン水、ないし70%エチルアルコールに保存する。成虫、サナギの死体も回収する。また、生きているサナギを見出したさいにはピペットでひろい上げて小さいピンで個別に飼育し、成虫とサナギの関連標本を作る。幼虫の脱皮殻を腹にひっかけているサナギもあり、それから成虫が羽化すると、1個体で3期の関連標本をうることができる。また、これとは別に底質から定量的ないし定性的に幼虫を回収し、固定標本としたり、個別に飼育してサナギ、成虫を回収することも試みた。

成虫、サナギ、幼虫の同定には主としてガムクロラル液封入標本によった。成虫の一部は三角紙片にはりつけて乾燥標本とした。

Polypedilum 属のサナギの呼吸管は封入標本とすると見えなくなるので、水に浮遊した状態で記録した。種の同定は原則として雄成虫で行い、その脱皮殻でサナギ、幼虫の記載をした。雌成虫はそのサナギの脱皮殻で種の判定をしたものが多い。

今回の調査は1979年8月17日に著者4名が南浅川の6地点で採集した底質より羽化した成虫を同定し、地点別に集計したものである。これらの各種の形態の記載は別に国立公害研究所研究報告集13-2に出版される。なお、この調査のほかに1979年12月12日にも同様の採集を行ったが、この成績についても別にとりまとめる予定である。

実験結果

今回の採集材料から羽化し種を同定しえた成虫は少なくとも総計37種、1070正にのぼり、最上流の1号地点では13種 58正、2号地点では14種 96正、3号地点では13種 105正、4号地点では2種 13正、5号地点では9種 475正、6号地点では7種 323正であった。このうち、4号地点で成虫の羽化が少なかったのはたまたま供試材料に幼虫が乏しかったためである。この成績から、水のきれいな上流部では種類数が多くて個体数が少なく、下流に向って下水の混入率が次第に高くなるにつれ、種類数は減少して個体数は増加するという傾向がうかがわれた。また、下水の混入率に応じて生息するユスリカ種が異なっていることが顕著にみられ、たとえば、(2)、(7)、(14)、(24)、(25)、(28)、(29)、(36)は最上流でその上には人家のない部分のみから採集され、(1)、(3)、(15)、(35)は1号と2号にわたり、(5)、(13)、(21)、(35)は2号と3号に見出されるというように、下水の混入量が多くなるにつれて逐次ユスリカ相も変っていく傾向がみられた。

逆に、*Chironomus* 属の2種(19,20)のように、最も汚染のひどい6号地点にだけ見出されるもの、あるいは(17)、(30)、(33)のように5号と6号にわたるものなど、富栄養化のすんだ水

域を好む種もあることが分かった。

これら各種のうち、広義の *Tanytarsus* 属 (1より12まで)、広義の *Polypedilum* 属 (13より18まで)、広義の *Cricotopus* 属 (28より33まで) はいずれもそれぞれの群内に貧栄養域にすむ種と、富栄養域にすむ種とその中間にすむ種などが見出された。それらは形態学的にきわめて近似している場合が多く、幼虫では区別困難な場合もあるので、このような方法で雄成虫を羽化させ、その交尾器の構造により厳密に種の区別を行うことがいかに大切であるかを示すものといえよう (こゝにあげた番号のうち、21以下の種は第3報に記載する)。

要 約

1. 多摩川の一支流の南浅川について、それより上流には人家がない最上流部から約2 km おきに、八王寺市内を流れてきわめて汚染の進んだ地点まで、6か所の川床の材料を採集し、これに生息するユスリカ科昆虫の種および個体数をしらべた。

2. 幼虫で採集された材料はいずれも実験室内で飼育して成虫を羽化させ、主として雄成虫の交尾器の構造により厳密に種を同定し、その脱皮殻によりサナギ、幼虫の形態もできる限り記載することとした。

3. 1979年8月17日に採集した材料からだけでも、以上の方法で少なくとも37種、1070の成虫が同定された。そのうちおよそ2/3が新種ないし日本未記録種であった。

4. 貧栄養域の上流部では一般に個体数は少ないが種類数は多く、富栄養化の進んだ下流部では種類数が少なく個体数の多い傾向が認められた。

5. 同じ水系でも下水の混入率に応じて生息するユスリカの種にすみわけが認められた。

とくに、広義の *Tanytarsus*, *Polypedilum*, *Cricotopus* などの属に含まれる各種の間で貧栄養部にすむ種と、中間部にすむ種と、富栄養部にすむ種とに顕著な差がみられることが注目された。

6. これにより、ユスリカ類を河川の汚染度の指標生物として利用しうる可能性があると考えられる。

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Part 2.

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4. <i>Rheotanytarsus tamaquartus</i> , sp. nov.	MFP	10-12	16
5. <i>Rheotanytarsus tamaquintus</i> , sp. nov.	MFP	13-15	18
6. <i>Rheotanytarsus kyotoensis</i> (Tokunaga, 1936)	MFPL	16-19	19
7. <i>Tanytarsus tamaseptimus</i> , sp. nov.	MFP	20-22	22
8. <i>Tanytarsus tamaoctavus</i> , sp. nov.	MFP	23-25	23
9. <i>Tanytarsus tamanonus</i> , sp. nov.	M	26-27	25
10. <i>Tanytarsus tamadecimus</i> , sp. nov.	M	28-29	26
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* M: male adult; F: female adult; P: pupa; L: larva

INTRODUCTION

As stated in the previous paper, a total of 20 species of the sub-family Chironominae have been recovered from sample materials collected at 6 stations of the Minamiasakawa River. It is extremely interesting that, with the exception of one species, which was tentatively identified as *Microtendipes britteni* (Edwards, 1929), because the morphological features mostly coincided with that described by Edwards (1929) and Pinder (1978), all the Chironominae found in this river were species indigenous to Japan, and 14 among them are reported as new species. This paper contains descriptions of 17 species of adult males, 15 species of female adults, 13 species of pupae, and 2 species of larvae, as shown in the contents. We have additional samples of adults, pupae and larvae collected from the same river, but these will be described later. The adults and immature stages of 3 other species among them, i.e., *Tanytarsus oyamai* Sasa, 1979, *Chironomus kiiensis* Tokunaga, 1936, and *Chironomus yoshimatsui* Martin et Sublette, 1972, were described in the previous papers of Sasa (1978, 1979). The nomenclature and abbreviations used in this paper are the same as those of previous papers, and those used by most European or American workers. The followings are explanations of abbreviations used in the text.

AR (antennal ratio): the ratio obtained by dividing the length of the last antennal segment with the combined length of all the preceding flagellar segments.

BR (beard ratio): length of the longest seta on tarsus I divided by the diameter of the segment from which it arises; *fBR* for the front leg, *mBR* for the middle leg, and *hBR* for the hind leg.

ER (eye ratio): distance between two eyes divided by the height of the eye.

LR (leg ratio): length of tarsus I divided by length of tibia; *fLR* for the front leg, *mLR* for the middle leg, *hLR* for the hind leg.

Acknowledgements

The author is greatly indebted to Dr. Takeshi Goda, project leader of the Special Research Project on Eutrophication of Land Waters of NIES, for the support of this study. Thanks are due to Dr. Masayuki Yasuno, Mr. Yoshio Sugaya, Miss Mihoko Ito and Mr. Tetsushi Kikuchi, for assistance in collection of the specimens, and to Dr. and Mrs. Cameron McLeod for editing and typing the manuscript.

DESCRIPTION OF SPECIES

I. TANITARSINI

(1) *Micropsectra tamaprima*, sp. nov.

Materials studied. Holotype: a male (A 43:21), emerged on 20 August from a bottom sample collected at Station No. 1 of the Minamiasakawa River, 17 August.

Paratypes: a male (A 43:22), same data; 3 females, emerged on 20 August (A 43:23), 11 September (A 43:24) and 20 September (fixed on pin), from samples collected at Station No. 2; 2 pupal exuviae (A 43:25, 26) associated with the females.

Male. (Plate 1, 2). Very small as a *Microspectra*, body length 2.82 and 2.84 mm, wing length 1.64 and 1.67 mm. Color almost uniformly pale yellow, scutal stripes reddish yellow. Antennal flagellum 13 segmented, AR 0.90. Palp 4 segmented (63, 145, 130, 265 microns). Eyes with microtrichiae along the inner margin, with a long dorsomedian projection, ER 0.44. Frontal tubercles absent. Supraorbital setae 12 on each side. Clypeal setae 15. Scutum with 20 dorsomedian setae, 12 dorsolateral setae on each side, and 3 supra-alar setae on each side; scutellum with 8 setae in a transverse row (Fig. 1-A). Wing as in Fig. 1-C and Table 1-1. Squama bare, anal lobe flat. Wing membrane with numerous macrotrichiae almost all over the surface. fCu almost under r-m. Relative length of leg segments as in Table 2-1. fLR 2.11. Front tibia with a sharply pointed and a flat terminal scales (Fig. 1-F). Terminal comb scales of middle and hind tibiae contiguous and without spurs (Figs. 1-G, H). All legs with long hairs, fBR 3.7, mBR 5.4, and hBR 7.6. Pulvilli absent (Fig. 1-E).

Hypopygium as in Figs. 2-A, B. Anal point parallel-sided, with rounded apex, and without spine groups; ninth tergite with 5 short hairs behind anal point and a pair of small triangular tubercles on the anterior margin (Fig. 2-C). Bands of ninth tergite separated in the middle. Appendage 1 (Figs. 2-F, G) egg-shaped, 68 microns long and 38 microns wide, with 2 or 3 hairs along the inner margin and with 6 hairs on the dorsal surface, with a long hair and numerous microtrichiae on the ventral side near base of appendage 1-a. Appendage 1-a knife-like, extending slightly beyond posterior margin of appendage 1. Appendage 2 (Figs. 2-D, E) long and slender, not swollen apically, with 14 apico-dorsal recurved setae, 2 caudally directed apical setae, and numerous microtrichiae almost all over the surface. Appendage 2-a 55 microns long, with spoon-like setae on the dorso-apical area, and simple, sharply pointed setae on the ventral and inner surface. Gonocoxite with concave inner margin and sharply pointed apex.

Female. (Plate 1). Wing length 1.74 and 1.84 mm. Coloration as in the male but generally darker, ground color of scutum yellow, scutal stripes reddish brown, femora and tibiae brownish yellow, tarsi yellow, abdomen green. Palp 4 segmented (39, 135, 128, 239 microns). Antenna 6 segmented (72, 116, 84, 94, 80, 116 microns), with a sub-terminal seta 155 microns long. Eyes with a long dorsomedian projection, ER 0.46 and 0.56, with microtrichiae along the inner margin. Supraorbital setae 10 on each side, clypeal setae 22. Scutum with 18 dorsomedian setae, 18 - 20 dorsolateral setae, and 3 or 4 supra-alar setae. Scutellum with 8 setae. Wing venation as in Fig. 1-1 and Table 1-1. Wing membrane with numerous macrotrichiae on the entire surface. fCu under r-m. Squama bare. Relative length of leg segments as in Table 2-1. fLR 2.19. Front tibia with a

narrow and pointed terminal scale as well as flat and rounded terminal scale (Fig. 1-L). Terminal comb scales of middle and hind tibiae contiguous and without spur (Figs. 1-M, N). Middle tarsus I with a row of specialized short (about 15 microns long) and erect setae along the anterior margin of the distal two thirds of the segment (Fig. 1-I). Pulvilli absent. Cercus and spermatheca Figs. 1-J, K.

Pupa. (Plate 3). Two female pupal exuviae were available for this study. Length of abdomen 3.08 and 3.03 mm. Thoracic respiratory organs tube-like, tapering towards apex, 0.53 mm long (including terminal seta), with numerous long and needle-like hairs excepting the basal portion (Fig. 3-A). Distribution of spines, spinules and hairs on abdominal tergites as in Figs. 3-B, C. Tergite II with a large central spinose area (spines are all very small; II-c), and a caudal transverse row of brown, recurved spines (each about 15 microns long, total number 98 and 105; II-d). Tergite III with a pair of spinose areas, which are united in the oral part by a spinulose zone; the spines in the inner and caudal corner of the spinose areas are long and sharply pointed, the longest one being 50 microns long, while they gradually decrease in size towards the lateral and oral sides (III-c). Tergites IV and V with a pair of well defined pigmented spine patches in the oral one third, which extend to a pair of spinose areas in the caudal side (IV-a and V-a). Tergites VI to VIII each with a pair of spinulose areas. Caudolateral scales of segment VIII with 3 marginal teeth (Figs. 3-D, E). The numbers of lateral hairs are 3 pairs in segments II to V, 4 pairs in segment VI and VII, and 5 pairs in VIII; the first and third pairs on segment IV and all lateral hairs on segments V to VIII are long and filamentous. Anal segment with a pair of long filamentous hairs on the dorsal side, and anal fins are each fringed with 40 long filamentous hairs (also see Table 3-1).

Discussion. This species is unique as a member of *Micropsectra* in that the body is very small, body color is largely yellow, and it has a relatively small AR value of 0.9 and a high LR value of 2.1. Among the known groups of this genus, it is, therefore, most closely related to the *attenuata* group of Reiss (1969), but differs from all of the five known species in the shape of appendage 1 (egg-shaped in this species, apically slender and pointed in the *attenuata* group). Tokunaga (1938, 1940) described a total of 5 species of *Micropsectra* from Japan, and the present species is closest to *Micropsectra daisenensis* (Tokunaga) in the body coloration and the structure of male hypopygium, but these again differ essentially in the body size, in the size of appendage 1-a (much longer in the present species), in the characteristics of setae on appendage 2-a, and in the presence of long beards on legs in the present species.

Pupa of this species has thoracic respiratory organs typical of the genus *Micropsectra*, i.e., long, tube-like and bear numerous long, needle-like hairs. The shape and structure of spinose and spinulose areas on abdominal tergites of the present species is similar to that of the *M. attenuata* group described by Reiss (1969). The difference in the number of spines on caudolateral scales of segment VIII (3 in this species, 4-7 in the *attenuata* group) is probably significant.

(2) *Rheotanytarsus tamasecundus*, sp. nov.

Materials studied. All the specimens studied here were collected at Station No. 1 of the Minamiasakawa River, 17 August 1979, and reared in the laboratory. Holotype: a male, emerged on 20 August, mounted in gum-chloral (No. A 43:01); Paratypes: two males (A 43:02, 03), emerged on 18 August, and a male (A 43:04), emerged on 22 August, all mounted in gum-chloral together with the associated pupal exuviae; 2 females (A 43:06, 07), emerged on 18 August, mounted in gum-chloral together with the pupal exuviae.

Male. (Plates 4, 5). Color almost uniformly pale yellow. Body length 1.60-1.82 mm (1.74 mm in average of 4). Wing length 1.05-1.07 mm (1.06 mm in average of 3). Antennal flagelum 13 segmented, the last segment unusually short, AR only 0.15-0.18 (0.17 in average of 4; Fig. 4-E). Palp 4 segmented (27, 56, 80, 145 microns). Frontal tubercles absent. Eyes with a long dorsomedial projection, ER 0.21; inner margin of eyes bears numerous microtrichiae. Clypeal hairs 14. Supraorbital hairs 8 on each side. Scutal stripes faint, scutum with 12 dorsomedian setae, 12 dorsolateral setae on each side, and one supra-alar seta on each side (Fig. 4-B). Scutellum with 6 setae. Wing venation as in Fig. 4-A and Table 1-2. Wing membrane with numerous macrotrichiae all over. R 2+3 not recognizable. fCu much beyond r-m. Relative length of leg segments as in Table 2-2. fLR 2.17. fBR 3.14. Front tibia with a long, slender and sharply pointed apical scale (Fig. 4-F). Middle and hind tibiae with two terminal comb scales which are clearly separated and both bearing a long spur (Fig. 4-G). Pulvilli absent.

Hypopygium as in Figs. 5-A, B. Anal point bare, without spine groups, and with lateral ridges (Fig. 5-C). Appendage 1 34 microns long and 19 microns wide, apically rounded and without beak-like inner projections, with 1 long basal seta, 3 inner and 3 apical setae (Fig. 5-C). Appendage 1-a absent. Appendage 2 about 52 microns long, slightly expanded apically, with 14 recurved setae and two caudally directed setae (Fig. 5-E). Appendage 2-a with a basal group of short and simple setae, and an apical group of extremely long and flattened setae, the latter reach far beyond tip of appendage 2 and to almost the tip of gonostylus (Fig. 5-E). Gonostylus rather abruptly narrowed distally, and with two rows of long setae along the inner margin.

Female. (Plate 4). One specimen was identified as a female of this species by the associated pupal skin. Color almost uniformly pale yellow. Body length 1.74 mm, wing length 1.26 mm. Antenna 6 segmented (including pedicel; 43, 75, 41, 48, 46, 65 microns), the last segment shorter than the second, with 3 subapical setae, and darker in color than the rest segments (Fig. 4-D). Palp as in Fig. 4-C. fER 0.47 (larger than in the male, as the dorsomedial projection is shorter). Clypeus with 20 setae. Supraorbital setae 8 on each side. Scutum with 12 dorsomedian setae, 11 dorsolateral setae and one supra-alar seta on each side; scutellum with 6 setae (Fig. 4-B). Wing venation similar in the male, as in Fig. 4-A and Table 1-2). Relative length of leg segments in Table 2-2; fLR 2.12. Cercus and spermathecae in Figs. 4-H, I.

Pupa. (Plate 5). Length of abdomen 1.68 mm in a male pupal skin and 1.72 mm in a female pupal skin. Thoracic respiratory organs (Fig. 6-B) horn-like, 0.38-0.43 mm long, curved rectangularly in about the middle, widest at near the base and tapering from about the middle towards the sharply pointed apex, with minute spinules on the distal half. Distribution of spines, spinules and hairs on abdominal tergites as in Fig. 6-B. Tergite II with a pair of small proximal spine patches (II-a) each composed of some 22 spines, a pair of small distal spine groups (II-c) composed of 3 or 4 large blunt spines and several small

spinules, and a transverse row of about 30 dark, recurved spines (each about 8 microns long) along the caudal margin (II-d). Tergites III and IV with a pair of proximal spine patches (III-a and IV-a) and a central spinulose zone. Tergites V and VI without spine patches and with a pair of central spinulose zones. Tergites VII, VIII and IX without spines and spinules. Abdominal segments II to V with 3 pairs of lateral hairs, segments VI and VII with 4 pairs, and VIII with 5 pairs of lateral hairs; those on segments II and III as well as the oral two pairs on IV are short and simple, while the rest more caudally located pairs are long and filamentous (Table 3-2). Caudolateral scales on VIII with a short and simple spine (Fig. 6-D). Anal lobes are fringed with 25-28 long filamentous hairs, and with a pair of simple hairs about 15 microns long (Fig. 6-E). Abdominal segments of pupal exuviae are only slightly pigmented along the lateral margins.

Discussion. Morphological characteristics of male and pupa of the present species indicate that it belongs to genus *Rheotanytarsus* Bause, 1913, of *Tanytarsus* in wider sense, as defined in details by Lehmann (1970). The structure of male hypopygium, especially the presence of extremely long apical hairs on appendage 2-a, indicates that this species is closely related to the European species *Rheotanytarsus distinctissimus* (Brundin, 1947). It was confirmed that the characteristics of *Tanytarsus* Type II pupa of Bause (1913), i.e., the presence of 3 or 4 blunt spines on distal part of abdominal tergite II, and the absence of spine patches on tergite V, can be applied to this group. This species differs from the two already described *Rheotanytarsus* species from Japan as well as those described from the Orient in the structure of male hypopygium, and from *Rh. distinctissimus* by the remarkable difference in the male antennal ratio (less than 0.2 in this species, 0.4 or higher in the European species).

(3) *Rheotanytarsus tamatertius*, sp. nov.

Materials studied. Two males (No. A 43:31, 32), emerged on 20 August 1979 from samples collected at Station No. 1 of the Minamiasakawa River, 17 August. Two pupal exuviae found on water surface of the same rearing tub on the same date (A 43:33). Another two males (A 43:34, 35), emerged also on 20 August, from a sample collected at Station No. 2 on the same date.

Male. (Plate 7, 8). Body coloration almost uniformly greenish yellow. Body length 1.70-2.11 mm. Wing length 1.18-1.26 mm. Antennal flagellum 13 segmented, the last segment very short, 0.11-0.22 mm, AR 0.23, 0.24, 0.46, 0.53 (Fig. 7-A). Palp 4 segmented (31, 75, 94, 159 microns). Frontal tubercles absent. Eyes with a long dorsomedial projection, ER about 0.3; eyes with microtrichiae along the inner margin (Fig. 7-B). Supraorbital setae 8 on each side. Clypeal setae 15-19.

Scutum with 12 dorsomedian setae, 10 dorsolateral setae and one supra-alar seta on each side; scutellum with 6 setae (Fig. 7-F). Wing membrane with macrotrichiae on the apical parts, basal portion of wing rather sparsely setigeous (Fig. 7-G). Squama bare. Wing venation as in Fig. 7-G and Table 1-3. fCu much beyond r-m. Relative length of leg segments as in Table 2-3. fLR 2.1-2.4. Front tibia with a sharply pointed apical scale (Fig. 7-C). Terminal comb scales of middle and hind tibiae widely separated, and each with a long spur (Figs. 7-D, E).

Hypopygium as in Figs. 8-A, B. Anal point slender, roughly parallel-sided, apex rounded, with lateral ridges but without spine clusters. Ninth tergite with two long hairs

at the base of anal point. Bands of ninth tergite separated in the middle (Fig. 8-F). Appendage 1 thumb-like, with rounded margin, and bears 2 or 3 setae on the inner margin, 5 or 6 setae on the dorsal surface, and one long seta on the ventral surface near the base (Figs. 8-D, E). Appendage 2 apically expanded, with 11 recurved setae and 2 caudally directed setae in the apical portion. Appendage 2-a relatively short and highly twisted, not reaching beyond tip of appendage 1, with about 10 stout and sharply pointed basal setae, and the distal lamellae which are separated into several flat and narrow lobes (Figs. 8-G, H). Gonocoxite as in Fig. 8-C, abruptly narrowed at about apical one third as in most other *Rheotanytarsus* males.

Pupa. (Plate 9). Length of abdomen 2.03 in one specimen and 1.97 mm in another. Thoracic respiratory organs simple, tube-like and smoothly curved, 0.50-0.53 mm long, rather abruptly narrowed in about the middle and the distal half being filamentous; the surface is rough but devoid of hairs or spines (Fig. 9-A). Distribution of spines and spinules on abdominal tergites as in Figs. 9-B, C. Tergites II to V with a pair of sharply defined, oval and pigmented spine patches (II-a to V-a). In addition, tergite II has a pair of distal spinose areas composed of some 20 very narrow spines (II-c), and a transverse row of some 30 dark spines each about 12 microns long. The central pairs of hairs on tergites IV and V are long and filamentous. Tergite V with spinulose areas lateral to the spine shields, and also in the caudolateral corners. Tergite VI without spines but with a pair of proximal spinulose areas and a pair of caudolateral spinulose areas. Tergite VII without spinose or spinulose areas. Tergites VIII and IX with a pair of small lateral spinulose areas. Segments II to V with 3 pairs of lateral hairs, and segments VI to VIII with 4 pairs of lateral hairs; the third pair of lateral hairs on segment IV as well as all those on segments V to VIII are long, filamentous swimming hairs. Caudolateral scales of segment VIII with a simple terminal spine (Fig. 9-D). Anal lobes fringed with 14-17 (average 15.0) filamentous hairs, and bear a pair of simple hairs on the dorsal surface near the lateral margins (Fig. 9-E). Male genital sheaths produced conspicuously beyond 9th tergite.

Discussion. The morphological characteristics of male and pupa of the present population are almost identical with those collected from running water in Kyoto and described in details by Tokunaga (1938) under the scientific name of *Tanytarsus* (*Rheotanytarsus*) *pentapoda* Kieffer. Especially noteworthy are the peculiar structures of anal point, appendages 2, 2-a and 1, and the shape of gonostylus. The values of AR and LR given by Tokunaga (0.68-0.72, and about 2.6, respectively) are both higher than in our specimens, but since both were very variable in our case, the differences could not be regarded as significant.

More recently, Lehmann (1970) gave detailed accounts on the morphological characteristics of European species of the genus *Rheotanytarsus* Bause, 1913. According to this article, the present populations are essentially different from *Rh. pentapoda* Kieffer in the structure of appendage 2-a (this is much longer and not twisted in *Rh. pentapoda*), and key out to *Rh. muscicola* Kieffer, which also has a short and twisted appendage 2-a. However, the distal lamellae of *Rh. muscicola* is a simple, broad and rounded lobe, while the present population bears narrow and pointed distal lamellae. In the pupa, the present species has a pair of well-defined spine patches on segments II to V (not on VI), but differs from the pupa of *Rh. muscicola* in that the spinulose area (chagreen) is absent on segments II, III and IV (*Rh. muscicola* has a pair of large chagreens on segments II to V which extend beyond the base of the first dorsal seta), and

also in that the present species has a pair of long and simple seta on the dorsal surface of anal lobes (this is absent in *Rh. curticornis*; the respiratory organ of the present species is simple, filamentous and with almost smooth surface, while that of *Rh. curticornis* has many spinules on the distal half. In the pupa, therefore, the present species is considered as being most closely related to *Rh. curtistylus* among the European *Rheotanytarsus* described by Lehmann (1970).

(4) *Rheotanytarsus tamaquartus*, sp. nov.

Materials studied. Holotype: a male (No. A 44:51), emerged on 20 August 1979, from a sample collected at Station NO. 2 of the Minamiasakawa River, 17 August. Paratypes: 14 males and 5 females, all from Station No. 2, collected 17 August. 10 pupal exuviae associated with the adults. All mounted in gum-chloral (No. A 44:52).

This species was found coexistence with the following species (*Rh. tamaquintus*), and both were quite similar in coloration and size, but males were separated by the antennal ratio and the structure of hypopygium, females by front leg ratio (fLR), and pupal exuviae by coloration (paler in the present species) and by the shape of spine patches on abdominal segments II-V.

Male. (Plates 10, 11). Body length 2.09-2.33 mm (2.21 mm in average of 10). Wing length 1.29-1.46 mm (1.40 mm in average of 10). Body coloration uniformly greenish yellow. Antennal flagellum 13 segmented, AR 0.69-0.78 (0.75 in average of 10, significantly larger than in the next species). Palp 4 segmented (39, 84, 92, 154 microns). Frontal tubercles absent. Eyes with a long dorsomedial projection, ER 0.25-0.32, with microtrichiae along the inner margin. Supraorbital setae 7 or 8 on each side. Clypeal setae 12-14.

Scutum with 10-12 (most commonly 12) dorsomedian setae, 8-10 dorsolateral setae on each side, and 1 supra-alar seta on each side; scutellum with 6 setae (Fig. 10-D). Wing as in Fig. 10-A and Table 1-4. Squama bare. Anal lobe flat. Wing membrane heavily haired, more hairy than in the next species, with macrotrichiae even in the basal portions of cells. R 1 and R 4+5 running close together, R 2+3 absent. fCu much beyond r-m. Relative length of leg segments as in Table 2-4. fLR 2.10-2.28 (2.19 in average of 8), mLR 0.60-0.64 (0.62 in average of 8), and hLR 0.69-0.76 (0.73 in average of 8). Femora, tibiae and tarsi I with relatively long beards, fBR 3.9, mBR 7.0, and hBR 5.9. Front tibia with a long and pointed terminal scale (Fig. 11-G). Terminal comb scales of middle and hind tibiae widely separated, and both with a long spur (Fig. 11-H). Pulvilli absent.

Hypopygium as in Fig. 11-A. Anal point (Fig. 11-B) slender, parallel-sided and with rounded apex, hardly pigmented, and without spine groups and microtrichiae. Lateral ridges of anal point are posteriorly open, and the circular ridge as seen in the next species is absent. Anal tergite with 5 or 6 short setae behind anal point, and several setae on both sides of anal point. Appendage 1 roughly egg-shaped but with a rectangular projection on the inner side, about 44 microns long and 22 microns wide, with 2 setae on the inner margin, 4 or 5 setae on the lateral margin and dorsal side, and a long seta on the ventral side (Fig. 11-E). Appendage 1-a absent. Appendage 2 apically expanded and stout, with about 12 setae subapically; appendage 2-a short and stout, subapical plate on the dorsal side being large and flat and with rounded margin, and with about 10 stout and simple setae on the ventral side (Figs. 11-C, D). Gonocoxite abruptly narrowed in apical one

third (Fig. 11-F).

Female. (Plate 10). Female of this species was difficult to separate from those of other coexisting *Rheotanytarsus* species but the specimens examined here were tentatively identified so by wing length, leg ratio, and the density of hairs on wing. Body length 1.84-2.11 mm (2.04 mm in average of 5). Wing length 1.37-1.50 mm (1.45 mm in average of 5). Coloration as in the male, almost uniformly greenish yellow, scutal stripes hardly distinguishable. Antennal flagellum 5 segmented (92, 55, 70, 63, 72 microns), with about 5 subterminal sensory setae (Fig. 10-B). Palp 4 segmented (36, 111, 99, 195 microns; Fig. 10-C). Frontal tubercles absent. Eyes kidney-shaped, dorsomedial projection shorter than in the male, ER 0.35-0.43, with microtrichiae along the inner margin. Supra-orbital setae 6-8 on each side. Clypeal setae 18-22.

Scutum with 12-14 dorsomedian setae, 14-20 dorsolateral setae on each side, and 1 supra-alar seta on each side. Scutellum with 6 setae (7 in one specimen). Wing as in Fig. 10-A and Table 1-4. Wing membrane more hairy than in the following species, macrotrichiae densely distributed on almost all the wing surface. Relative length of leg segments as in Table 2-4. fLR 2.42-2.49 (2.45 in average of 5), higher than in the male, and also significantly higher than 2.00-2.06 of female of the next species. Cercus 34 microns long and 51 microns wide, with rounded posterior margin (Fig. 10-H). Spermathecae as in Fig. 10-G.

Pupa. (Plate 12). Length of abdomen 1.95-2.42 mm (2.13 mm in average of 8, significantly longer than the preceding species). Thoracic respiratory organs 0.47-0.55 mm long (0.51 mm in average of 8), filamentous and tapering towards apex, with a few fine spinules on the distal one third (Fig. 12-A). Distribution of spines, spinules and hairs on abdominal tergites as in Figs. 12-B, C. Tergites II-V with a pair of pigmented and well defined spine patches in the proximal part, and those on tergites IV and V accompany spinulous areas extending towards the caudal side (in the next species the spinulous areas extend towards the lateral side). Tergite VI with a pair of small spine patches, and diffuse spinulous areas in the middle. Tergites VIII and IX with a pair of lateral spinulous areas near the oral margin. Anal segment with a pair of long hairs on the dorsal side, and fringed with 17-21 long filamentous hairs. The numbers of lateral hairs are 3 pairs from segment II to V, and 4 pairs from VI to VIII; the third pair of segment V and all pairs of segments VI to VIII are long and filamentous (Table 3-4).

Discussion. The present species is morphologically quite similar to the next species (*Rh. tamaquintus*), and since both species coexist in the same habitat, great care should be taken for the differentiation. In general, the present species is smaller in body size. In the male, antennal ratio is significantly greater in the present species, and the structure of basal portion of anal point (presence or absence of circular ridge at the base of anal point) is the most remarkable point for the differential diagnosis. In the female, the only characteristics which was found useful for differentiation is the leg ratio (LR) of front leg. The shape of cercus is probably different. The structure of pupa is also quite similar, but can be differentiated by the color of exuviae (darker in the next species), and by that the spine patches on tergites II to V are better defined in the next species (the borderline is more diffuse in the present species). The spinulous areas on tergites IV and V are on the lateral side of the spine patches in the next species, while they are on the caudal side in the present species.

Among the European *Rheotanytarsus* described by Lehmann (1970), the present species is closest in structure of male hypopygium and pupal chaetotaxy to *Rh.*

curtistylus (Goetghebuer, 1921); however, body coloration is quite different (thorax dark brown in *Rh. curtistylus*), AR is almost the same, LR much smaller in *Rh. curtistylus* (1.5-1.6), the shape of gonostylus is different (abruptly narrowed in the distal one third in the present species), and appendage 2-a is similar in structure but probably longer in *curtistylus* than in the present species.

(5) *Rheotanytarsus tamaquintus*, sp. nov.

Materials studied. 10 males, reared between 18 August and 29 August 1979, from bottom samples collected at Stations No. 2 and No. 3 of the Minamiasakawa River, 17 August. 7 females, identified by structure of pupal exuviae, same data. 10 pupal exuviae, same data. 2 larval skin casts, associated with pupae and adult males.

Male. (Plate 13, 14). Body length 1.82-1.95 mm (1.90 mm in average of 6). Wing length 1.11-1.22 mm (1.18 mm in average of 8). Coloration pale yellow or greenish yellow, scutal stripes hardly distinguishable. Antennal flagellum 13 segmented, AR 0.38-0.47 (0.42 in average of 8), significantly smaller than in the preceding species (Fig. 13-D). Palp 4 segmented (31, 70, 87, 145 microns). Eyes with a conspicuous dorsomedial projection, ER 0.26-0.32; pubescent along the inner margin. Supraorbital setae 6-8 on one side. Clypeal setae 12-14. Frontal tubercles absent.

Scutum with 14 or 15 dorsomedian setae, 8 or 9 dorsolateral setae on each side, and 1 supra-alar seta on each side. Scutellum with 6 setae. Wing as in Fig. 13-A and Table 1-5. Macrotrichiae rather scanty, those in cell R-M and M-Cu are uniserial except for the marginal portions, basal part of cell Cu free from macrotrichiae. R 1 and R 4+5 running close together, R 2+3 absent. Relative length of leg segments as in Table 2-5. fLR 1.97-2.06 (2.01 in average of 8), mLR 0.56-0.61 (0.58 in average of 8), and hLR 0.67-0.71 (0.69 in average of 8). Front tibia with a long and sharply pointed terminal scale (Fig. 14-H). Terminal comb scales of middle and hind tibiae separated, and both with a long spur (Fig. 14-I). fBR 2.0, mBR 3.6, and hBR 2.1. Pulvilli absent.

Hypopygium as in Fig. 14-A. Anal point slender, somewhat constricted in the middle and expanded apically, with rounded apex, and most characteristic among all is the presence of a circular ridge at the base of anal point formed by extension of lateral ridges (Figs. 14-B, C). Ninth tergite with 2 or 3 short hairs near base of the circle. Bands of ninth tergite widely separated in the middle. Appendage 1 ovoid, basal part of inner margin concave, with 2 setae on the inner margin, 4 setae on the lateral margin, and one long seta on the ventral side (Fig. 14-E). Appendage 1-a absent. Appendage 2 relatively short and stout, slightly expanded apically, and with about 10 recurved hairs and 1 or 2 caudally directed hairs; dorsal surface of appendage 2 free from microtrichiae except for the inner margin. Appendage 2-a extending slightly beyond tip of appendage 1, with a row of 6 or 7 stout and simple setae on ventral side and a large flat distal plate with 2 or 3 points on dorsal side (Figs. 14-F, G). Distal part of gonostylus not abruptly tapered (Fig. 14-D).

Female. (Plate 13). A single female was confirmed by the associated pupal skin as representing this species. This specimen showed fLR of 2.00. Additional 5 specimens were tentatively identified as female of this species and separated from those of the following species by the value of fLR. Description is mainly based on the confirmed specimen (No. A 44-71). Body coloration as in male, almost uniformly pale yellow, scutal stripes inconspicuous. Body length 1.42-2.00 mm, wing length 1.11-1.34 mm. Antenna 6

segmented (40, 65, 40, 55, 39, 63 microns), the last segment darker than the preceding segments and bears 4 short subterminal sensory setae (Fig. 13-C). Palpi 4 segmented (19, 51, 84, 147 microns; Fig. 13-B). Frontal tubercles absent. Dorsomedial projection of eyes relatively short, ER 1.0. Supraorbital setae 5-7 on one side. Clypeal setae 14 or 15. Scutum with 12-14 dorsomedian setae, 10-12 dorsolateral setae on each side, and 1 supraalar seta on each side. Scutellum with 6 setae. Wing venation as in Fig. 13-A and Table 1-5. Wing less hairy than in the preceding species, basal portion of cell Cu bare. R 1 and R 4+5 running close together, R 2+3 absent. fCu much beyond r-m. Relative length of leg segments as in Table 2-5. fLR 2.00-2.06 (2.038 ± 0.022 in 5), and significantly smaller than in the preceding species. Front tibia with a long and sharply pointed terminal scale (Fig. 13-G). Terminal comb scales of middle and hind tibiae separated, and both with a long spur (Figs. 13-H, I). Spermathecae as in Fig. 13-E. Cercus longer than wide (46 microns long and 41 microns wide; Fig. 13-F).

Pupa. (Plate 15). Length of abdomen 1.63-1.79 mm (1.70 mm in average of 8, shorter than in the preceding species). Thoracic respiratory organs 0.40-0.46 mm (0.43 mm in average of 8), filamentous and tapering towards apex, with fine spinules on the distal half (Fig. 15-A). Abdomen of pupal exuviae dark brown (darker than in the preceding species). Abdominal tergites II to IV with a pair of well defined and pigmented spine patches in the oral part; those on tergites II and III are wider than long and not accompanied by spinulous areas, while those on tergites IV and V are longer than wide, and with a spinulous area on the lateral side (Figs. 15-B, C). Tergite II with a distal spinose area (II-c), and a transverse row of dark and recurved hooks (II-d). Tergite VI without spine patches and with a diffuse spinose and spinulous area. Tergite VII free from spines and spinules. Tergites VIII and IX with a pair of oral spinulous areas. Caudolateral scales of segment VIII with a simple terminal spine (Fig. 15-D). Segments II to V with 3 pairs of lateral hairs, and VI to VIII with 4 pairs of lateral hairs; the third pair of segment IV and all those on segments V to VIII are long and filamentous (Fig. 15-B). Anal segment with a pair of long hairs on the dorsal side, and fringed with 17-20 (most commonly 18) long filamentous hairs (Fig. 15-D).

Discussion. The structure of male hypopygium as well as the chaetotaxy of pupa indicate that the present species belongs to the genus *Rheotanytarsus* Bause. As stated previously, the present species is similar in morphology of adults and pupae to the preceding species, *Rh. tamaquartus*, sp. nov. However, the presence of a curcular ridge at the base of anal point of male hypopygium is quite characteristic, and can be easily differentiated from other *Rheotanytarsus* species.

In the pupa, the distribution of spine patches on abdominal tergites as well as the chaetotaxy of lateral hairs is most closely related to *Rh. photophilus* among the pupae of European species described by Lehmann (1970), but the present species differs again from it in the presence of a pair of long setae on the dorsal surface of anal segment, and in the absence of spinules on tergites II and III lateral to the spine patches.

(6) *Rheotanytarsus kyotoensis* (Tokunaga, 1938).

Materials studied. A total of 203 males and 208 females were reared from bottom samples collected at Station No. 5 (under Tamagoryo Bridge) of the Minamiasakawa River, 17 August 1979. 23 males and 12 females were mounted in gum-chloral and

examined (No. 42:01 -). Large numbers of pupal exuviae and larvae were recovered from the same samples, of which 20 pupal exuviae and 12 larvae were mounted in gum-chloral.

Male. (Plates 16, 17). Body almost uniformly pale yellow, with the exception of antennal shaft (yellowish brown), eyes (dark brown), scutal stripes and postnotum (brownish yellow). Halteres entirely yellow. Body length 2.37-2.82 mm (2.62 ± 0.16 mm in measurements of 10). Wing length 1.32-1.50 mm (1.42 ± 0.06 mm in measurements of 10).

Antennal flagellum 13 segmented, AR 0.70-0.90 (0.83 ± 5.9 in 10). Palp 4 segmented (36, 96, 106, 195 microns). Frontal tubercles absent. Eyes with a dorsomedial projection, distance 80-94 microns and 0.27-0.48 times the height of eyes. Clypeal hairs 16-20, supraorbital hairs 8-10. Hairs on scutum and scutellum as in Fig. 16-E; dorsomedian hairs 12-18, dorsolaterals 7-11, supra-alar 1, scutellum with 6 (4 in one specimen) hairs in examination of 11. Wing as in Fig. 16-A and Table 1-6; squama bare; wing membrane with numerous macrotrichiae; R 1 and R 4+5 closely set, R 2+3 absent. fCu apical of r-m; anal lobe very flat. Relative length of leg segments as in Table 2-6; fLR 1.96-2.29 (2.12 ± 0.08 in 10), mLR 0.60-0.63 (0.614 ± 0.8), hLR 0.63-0.71 (0.665 ± 0.020 , all 10 specimens). Terminal scale of front tibia narrow and sharply pointed, about half as long as diameter of the end of tibia (Fig. 17-A). Comb scales on middle and hind tibiae widely separated, both with a long spur (Fig. 17-B). Hairs on front tarsus I about twice as long as diameter of the segment. Pulvilli vestigial.

Hypopygium as in Fig. 17-C. Anal point slender, parallel-sided, without spine groups. Ninth tergite with several hairs behind base of anal point, but without other specialized setae (Fig. 17-E). Appendage 1 roughly egg-shaped, about 32 microns long and 22 microns wide, with 2 hairs on the inner margin and 4-6 hairs on the dorsal surface near lateral margin (Fig. 17-D). Appendage 1-a broad, usually extending beyond inner margin of appendage 1, and with a long seta at its base (Fig. 17-D). Appendage 2 expanded apically, with about 15 recurved stout hairs on the dorsal surface near the apex; appendage 2-a slightly longer than appendage 2, with numerous hairs on the stem, and apically bilobed and expanded like a boxing globe, both lobes heavily striated (Figs. 17-F, G). Gonostylus tapering towards the apex, apically rather pointed, with an apical spur and two rows of relatively long hairs along the inner margin (Fig. 17-C).

Female. (Plate 16). Body length 1.71-2.74 mm (2.07 mm in 7 gum-chloral mounted specimens). Wing length 1.46-1.59 mm (1.53 ± 0.04 mm in 10). Body coloration as in the male, ground color of scutum yellow, scutal stripes reddish yellow; scutellum, postnotum, halteres yellow, abdomen greenish yellow, legs yellow or brownish yellow. Antennal flagellum 5 segmented (101, 60, 70, 58, 89 microns, Fig. 16-B). Palpi 4 segmented (39, 94, 108, 174 microns, Fig. 16-C). Eyes with a dorsomedial projection, ER 0.28-0.46 (0.37 in average of 8, Fig. 16-F). Supraorbital setae 6-10 on each side; clypeal setae 16-32 (23.2 in average of 8). Scutum with 16-24 dorsomedian setae (19.3 in average of 8), 12-26 dorsolateral setae on each side (18.0 in average of 8), and one supra-alar seta on each side; scutellum with 5-8 setae (usually 6, Fig. 16-D). Wing as in Fig. 16-A and Table 1-6. Squama bare, anal lobe flat, membrane with numerous macrotrichiae. R 1 and R 4+5 close and parallel, R 2+3 absent. fCu far beyond r-m. Relative length of leg segments as in Table 2-6; fLR 2.02-2.29 (2.12 ± 0.10 in 9), mLR 0.53-0.60 (0.57 ± 0.03 in 9), and hLR 0.58-0.65 (0.62 ± 0.02 in 9). Cercus and spermathecae as in Figs. 16-G, H.

Pupa. (Plate 18). Length of abdomen 3.26-3.95 mm (3.57 ± 0.24 mm in measurements of 10). Thoracic respiratory organs long, slender, length 0.39-0.54 mm (0.43 ± 0.04 mm in

10 pairs), width 0.019-0.022 mm; tapering towards apex, surface smooth and without hairs or spines (Fig. 18-A). Distribution of spines and spinules on abdominal tergites as in Fig. 18-B. Segment I without spines and spinules. Tergite II with a pair of proximal pigmented spine patches (II-a), a pair of distal spine groups (II-c), and a uniserial row of 62-102 recurved spines along the posterior margin (II-d). Tergite III, IV and V with a pair of proximal pigmented spine patches (III-a, IV-a, V-a), and a pair of sparse spinose areas in the middle. Tergite VI with a pair of sparse spinose areas in the middle. Tergite VII with a pair of spinulous areas along the oral margin (VII-a). Tergite VIII with a pair of small spinulous areas in the lateral corners (VIII-a). Sternites IV and V with a pair of spine groups in the caudolateral corners (IV-v and V-v). Segments II to VI with 3 pairs, and segments VII and VIII with 4 pairs of lateral hairs; the third pair of segment IV and all those on segments V to VIII are long and filamentous (Table 3-6). Caudolateral scales of segment VIII composed of a rather stout and sharply pointed spine (Fig. 18-D). Anal fin with 15-26 (21.45 ± 2.67 in 10 pairs) filamentous hairs on lateral margins, and a pair of long, simple hairs on the dorsal side (Fig. 18-E).

Larva. (Plate 19). Color in life pink or greenish pink. Body length of mature larvae 2.34-3.24 mm (2.84 ± 0.31 mm in 10 gum-chloral mounted specimens). Head about 280 microns long and 215 microns wide, ratio 1.3. Antenna 5 segmented (87, 27, 11, 5, 3 microns; Fig. 19-C); antennal base 35 microns high and 60 microns in diameter; segment I long and curved, 1.9-2.4 times the combined length of segments II to V, with a ring organ near the base and an antennal hair arising from at 0.6 level from base; antennal blade slightly longer than the combined length of segments II to V; Lauterborn's organ situated on a short petiole about 17 microns long; segment II expanded towards apex. Mandible (Fig. 19-D) with 4 cutting teeth, with a row of subapical comb hairs, and with a brush near base. Labial plate (Fig. 19-A) with 11 teeth, the central tooth widest and notched on both sides. Paralabial plates narrow and wide, 20 microns long and 72 microns wide, only about 3 microns apart from each other. Labrum, epipharynx and premandibles as in Fig. 19-B. Claws on anterior pseudopods all simple (Fig. 19-E). Thorax 3 segmented, with long and rigid hairs. Base of anal hair tuft longer than wide (Fig. 19-G), bears 7 long and 2 short hairs. Anal segments as in Fig. 19-H; posterior pseudopods with 15 claws. (Fig. 19-F).

Discussion. The present species is interesting in that it was collected in large numbers from Station No. 5 of the river, at the site where the water is much more polluted than the sites at which other *Rheotanytarsus* species were found. The morphological characteristics of males and females were almost identical with the description of *Tanytarsus* (*Tanytarsus*) *kyotoensis* of Tokunaga (1938, p. 345). Pupa and larva are new records, and their morphological characteristics fit quite well to the definition of *Rheotanytarsus* given by Bause (1913). The structure of male hypopygium is also typical of this group, since the anal point lacks in the spine clusters, and gonostylus is rather abruptly narrowed at about distal one third. However, it is unusual as a member of this group in that it has appendage 1-a. The structure of appendage 2-a is quite characteristic to this species.

The structure of pupa is closest to that of *Rh. curtistylus* among the European species described by Lehman (1970), since the pair of well defined spine patches are found on tergites II to V, anal segment bears a pair of long, simple hairs on the dorsal surface near the bases of filamentous hairs, and thoracic respiratory horn is almost bare.

Although Tokunaga (1938) regarded this species as a member of *Tanytarsus* s. str., the

present author considers it as to belong to *Rheotanytarsus*, because the structure of larvae and pupae fits quite well to the definition given by Bause (1913), and the characteristics of adults are also typical to this group except for the presence of appendage 1-a.

(7) *Tanytarsus tamaseptimus*, sp. nov.

Materials studied. 3 males (No. A 43:71, 72, 73), emerged on 23 and 24 August 1979, from bottom samples collected at Station No. 1 of the Minamiasakawa River, 17 August. 3 pupal exuviae associated with the males (No. A 43:73, 76, 77).

Male. (Plates 20, 21). Very small species, body length 1.32 and 1.39 mm, wing length 0.92 and 0.95 mm. Body coloration generally yellowish green, scutal stripes and post-notum brown. Legs, halteres and abdomen pale yellow. Head as in Fig. 20-B. Antennal flagellum with 10 segments only, AR 0.69 in one and 0.68 in another (Fig. 20-A). Palpi 4 segmented (26, 60, 75, 104 microns). Eyes with microtrichiae along the inner edge, otherwise bare. Dorsomedial projection of eyes relatively short, 152 microns apart from each other and 111 microns high, ER 1.37. Small conical frontal tubercles present (Fig. 20-C). Supraorbital setae 7 on one side. Clypeal setae only 10.

Scutum with 8 dorsomedian setae, 8 dorsolateral setae on each side, and one supra-alar seta on each side. Scutellum with 8 setae. Antepre-notum highly reduced in the middle (Fig. 20-I). Wing venation as in Fig. 20-D and Table 1-7. Squama bare, anal lobe flat. Wing membrane with macrotrichiae as in Fig. 20-D; they are rather sparse except for the marginal parts of the wing, and arranged only in a single row in cells R-M and M-Cu, and along An-vein. R 2+3 obsolete. R 4+5 ending above Cu 1. fCu far beyond r-m. Relative length of leg segments as in Table 2-7. fLR 1.78, fBR 3.8. Front tibia with a narrow and sharply pointed terminal scale (Fig. 20-E). Terminal comb scales of middle and hind tibiae narrow and well separated, one with a long spur and the other without a spur (Figs. 20-F, G). Pulvilli absent.

Hypopygium as in Figs. 21-A, B. Anal point triangular, with pointed apex, with a pair of lateral ridges, and several clusters of spine groups (Fig. 21-C). Ninth tergite with a group of 5 long setae near the base in the middle, and several short setae on both sides of anal point (Fig. 21-C). Appendage 1 kidney-shaped, 30 microns long and 14 microns wide, without microtrichiae but with 7 setae along the posterior margin (Fig. 21-D). Appendage 1-a lacking. Appendage 2 long and slender, about 55 microns long and 10 microns wide at the widest point near the apex, narrowest in about the middle, and bears only 5 setae (4 recurved, 1 directed caudally) in the terminal part; appendage 2-a simple, tapering towards the pointed tip, and bears numerous simple setae (Fig. 21-E). Gonostylus widest near the base and narrowed gradually from about the middle towards the pointed apex (Fig. 21-F).

Pupa. (Plate 22). Length of abdomen of pupal exuviae 1.37, 1.45 mm. Thoracic respiratory organs (Fig. 22-A) filamentous, 0.47-0.49 mm long, with only a few spines on the distal half. Distribution of spines and spinules on abdominal segments as in Figs. 22-B, C. Pupa of this species is characteristic as a member of Tanitarsini in that all the spines on abdominal tergites are very narrow and slender, about 15 microns long and less than 1 micron wide, with a hook near the terminal end, and not pigmented. Abdominal tergite II with a central spinose area (II-b) and a terminal transverse row of about 30 recurved

spines each about 5 microns long (II-d). Tergites III to VI with a paired central spinose areas. Tergites VII to IX with a paired proximal spinulose areas. Caudolateral scales on segment VIII bears a long, simple terminal spine (Fig. 22-D). Abdominal segments II to V with 3 pairs of lateral hairs, VI and VII, with 4 pairs, and VIII with only 3 pairs of lateral hairs; the second pair of segments III and IV as well as all those on segments V to VIII are long and filamentous (Table 3-7). Anal lobes fringed with 16 filamentous hairs but without dorsal hairs in all the 3 specimens examined (Fig. 22-D).

Discussion. This species obviously belongs to Tanitarsini and is tentatively placed in the genus *Tanytarsus*, but the author has not been able to find a relative among the known species. In the male, it is peculiar in that the wing is rather sparsely haired (Fig. 20-D), terminal comb scales of middle and hind tibiae are widely separated and only one of them bears a long spur and the other is unarmed, anal point is triangular and with both spine groups and lateral ridges, appendage 1-a absent, appendage 2 long, slender and with only about 5 recurved setae (Fig. 21-E), appendage 2-a with many simple hairs, gonostylus not abruptly narrowed but with pointed apex. In the pupa, this species is also peculiar in that it has no clearly defined spine patches on the abdominal tergites, the spines are all pale, slender and with a terminal hook, caudolateral scales of segment VIII with only one long and simple terminal spine, segment VIII with only 3 filamentous hairs, and anal lobe is devoid of dorsal hairs and fringed with only 16 filamentous hairs.

(8) *Tanytarsus tamaoctavus*, sp. nov.

Materials studied. Holotype: a male (No. A 43:51), emerged on 14 September 1979 from a bottom sample collected at Station No. 3 of the Minamiasakawa River, 17 August. Paratypes: 5 males (A 43:52 to 56; 2 collected at Station No. 1; 2 at No. 2; 1 at No. 4, same date). 2 females (A 43:61, 62), identified by the associated pupal exuviae. 2 male and 2 female pupal exuviae associated with the adults.

Male. (Plates 23, 24). Body coloration almost uniformly pale yellow. Body length 2.16-2.37 mm (2.27 mm in average of 6). Wing length 1.27-1.39 mm (1.32 mm in average of 5). Antennal flagellum 13 segmented, AR 0.62-0.70 (0.65 in average of 5). Eyes with microtrichiae along the inner margin, dorsomedial projection rather short, ER 0.86-1.07 (0.94 in average of 5). Frontal tubercles absent. Clypeal setae 10-14 (12.6 in average of 5). Supraorbital setae 9 or 10 on one side.

Scutum with 8-12 dorsomedian setae, 6 or 7 dorsolateral setae on one side, and one supra-alar seta on each side. Scutellum with 6 setae. Wing venation as in Fig. 23-A and Table 1-8. Squama bare. Anal lobe flat. Wing membrane with macrotrichiae. R 2+3 clearly separated from R 1. fCu far beyond r-m. Relative length of leg segments as in Table 2-8. fLR 2.37-2.57, mLR 0.60-0.62, and hLR 0.70-0.75. Front tibia with a long and sharply pointed terminal scale. Terminal comb scales of middle and hind tibiae widely separated, and both with a long spur. Tarsi without long beards. Pulvilli absent.

Hypopygium as in Figs. 24-A, B. Anal point (Fig. 24-C) slender, roughly parallel-sided, slightly expanded in the middle, with 3 or 4 spine groups and about 5 pairs of lateral hairs. Ninth tergite with two short hairs near the base of anal point. Bands of ninth tergite separated in the middle. The structure of appendage 1-a is most characteristic to this species; it extends much beyond the inner margin of appendage 1, and expanded and twisted as in Figs. 24-F, G. Appendage 1 roughly egg-shaped, about 24 microns long and

15 microns wide, with 2 hairs on the inner margin and 4 hairs on the posterior margin (Fig. 24-F). Appendage 2 rather stout and not expanded apically, with 12 long and recurved setae on the apical part, and numerous microtrichiae all over the surface. Appendage 2-a absent (this is a remarkable characteristic of this species). Gonostylus as in Fig. 24-E.

Female. (Plate 23). Coloration as in the male, almost uniformly pale yellow, scutal stripes inconspicuous. Body length (in 2 specimens) 1.47 and 1.63 mm. Wing length 1.27 and 1.30 mm. Antennal flagellum 5 segmented (84, 60, 72, 36, 99 microns), the terminal and the preterminal segments are incompletely separated, the terminal segment darker (brown) than the rest segments and with 3 preapical setae (Fig. 23-B). Palpi 4 segmented (39, 87, 108, 176 microns, Fig. 23-C). Frontal tubercles absent. ER 0.54. Clypeus with 16 or 17 setae. Supraorbital setae 7, 8 or 9 on one side. Scutum with 14 dorsomedian setae, 12 dorsolateral setae and 1 supra-alar seta on each side. Scutellum with 4 setae. Wing as in Fig. 23-A and Table 1-8. R 2+3 clearly separated from R 1. fCu much beyond r-m. Relative length of leg segments as in Table 2-8. fLR 2.53, mLR 0.56, and hLR 0.70 (values similar to those of male). Middle tarsus I with a row of comb-like setae (Fig. 23-G). Spermathecae and cercus as in Figs. 23-H, I.

Pupa. (Plate 25). Length of abdomen 1.93-2.17 mm (2.10 mm in average of 4). Thoracic respiratory organs tube-like, 0.59-0.62 mm long, widest near the base and tapering towards the apex, with numerous fine spines on the distal two thirds (Fig. 25-A). Distribution of spine groups and spinulose areas on abdominal tergites as in Figs. 25-B, C. Tergite I without spines and spinules. Tergite II with a pair of proximal spine patches (II-a) which are surrounded by spinules and not so clearly defined as those on tergites III-VI, large central spinulose areas (II-b and II-c), and a caudal transverse row of 32-34 recurved spines each about 8 microns long. Tergites III to VI with a pair of proximal spine patches (III-a to VI-a) which are all clearly defined and pigmented. Tergite III with a spinulose area between the spine patches. The numbers of spines on the spine patches of tergites II to VI in one of the specimen are 22 and 22, 43 and 44, 28 and 32, 26 and 27, 18 and 20, respectively. Segments VIII and IX with a pair of lateral spinulose areas near the oral margin. Caudolateral scales on segment VIII bear one large spine and 8-12 small accessory spines (Fig. 25-D). The numbers of lateral hairs are 3 pairs in segments II to VI, 4 pairs in VII, and 5 pairs in VIII, among which the second pair of segment VI, the second to the fourth pairs of VII and all the five pairs of VIII are long and filamentous, while the rest pairs are short and simple (Table 3-8). Anal fins fringed with 30-34 (31.8 in average of 4) filamentous hairs on one side, and 2 pairs of filamentous hairs on the dorsal side (Fig. 25-D).

Discussion. According to the structure of male hypopygium, the present species is considered as belonging to the *curticornis-brundini* complex of *Tanytarsus* described by Lindberg (1963), and Reiss & Fittkau (1971), because its anal point has lateral ridges and spine groups, but without microtrichiae between the ridges, bands of anal tergite are separated in the middle, and most characteristic of all is the large and twisted appendage 1-a. *Tanytarsus curticornis* Kieffer and *T. brundini* Lindberg have been found breeding in lakes in northern Europe, while the present species was collected from running water. It is apparently closer to *T. brundini* than to *T. curticornis* in that it has two median bristles on anal tergite, and only 3 spine groups on anal point. However, this species differs from the above European species in the complete absence of appendage 2-a (this is quite

unusual as a *Tanytarsus*).

In the pupa, this species is peculiar in that its abdominal tergite II has a large spinose area and the proximal spine patches are ill-defined, while it has well-defined spine patches on tergites III to VI (this is absent on tergites VI in most other species), and the long and filamentous lateral hairs are seen only with the second pair of abdominal segment VI, the second, third and fourth pair of VII, and all the five pairs of VIII. According to Lindberg (1963), the numbers of filamentous hairs on abdominal segments V - VIII are usually 1, 1, 3, 5 in *T. brundini* and 2, 2, 3, 5 in *T. curticornis*, while it is 0, 1, 3, 5 in this species. The presence of two pairs of filamentous hairs on dorsal side of anal fins is also characteristic to this species.

(9) *Tanytarsus tamanonus*, sp. nov.

Materials studied. A male, emerged on 23 August 1979 from a sample collected at Station No. 3 of the Minamiasakawa River, 17 August.

Male. (Plates 26, 27). Body length 1.67 mm, wing length 1.00 mm. Body coloration almost entirely pale yellow, scutal stripes brown. Head as in Fig. 26-C. Antennal flagellum with only 10 segments, AR 0.43 (Fig. 26-A). (Palpi missing from the third segment). Eyes bare, reniform and widely separated from each other, ER 1.60. Frontal tubercles conical, contiguous in the middle, 40 microns wide and 17 microns high (Fig. 26-C). Supraorbital setae 8 on each side. Clypeal setae 11.

Scutum with 10 dorsomedian setae, 6 and 7 dorsolateral setae, and 1 supra-alal seta on each side. Wing venation as in Fig. 26-B and Table 1-9. Squama bare. Wing membrane with macrotrichiae along the midline between R 4+5 and M, and near the tip of the wing, on veins M and Cu 1, and along midline between M and Cu 1; macrotrichiae are absent from basal two thirds of the wing as well as in cell Cu. Relative length of leg segments as in Table 2-9. fLR 1.77, mLR 0.52, hLR 0.68. Front tibia with a long, narrow and sharply pointed apical scale (Fig. 26-D). Terminal comb scales of middle and hind tibiae narrow and separated, both with a long spur (Fig. 26-E). Pulvilli absent.

Hypopygium as in Figs. 27-A, B. Ninth tergite with 6 short hairs near the base of anal point. Anterior margin of ninth tergite with a pair of lateral tubercles. Bands of ninth tergite united in the middle (Y-shaped). Anal point relatively wide and short, with rounded apex, with microtrichiae on the entire dorsal surface, lateral ridges vestigial, spine clusters absent. Appendage 1 25 microns long and 12 microns wide, roughly egg-shaped but apically truncate, with 3 setae on the inner margin, 3 setae on the dorsal surface, and 2 setae on the lateral margin (Fig. 27-F). Appendage 1-a 17 microns long, knife-shaped, and extends far beyond the posterior margin of appendage 1 (Fig. 27-G). Appendage 2 65 microns long, almost straight and only slightly expanded apically, dorsal surface almost bare excepting the marginal parts, and bears 9 subapical setae; appendage 2-a 25 microns long, with stout and simple setae (Fig. 27-H). Gonostylus 58 microns long, and with a strong longitudinal ridge on the ventral side (Figs. 27-D, E).

Discussion. The present species seems to belong to *Tanytarsus* group of Edwards (1929), or *Cladotanytarsus* Kieffer, because the wing has macrotrichiae only in the apical area, tibial combs are well separated and both with a long spur, pulvilli are absent, and a small species with LR of about 1.7. Among the known species of this group, the present species seems to be most closely related to *C. van-der-wulpi* Edwards, 1929, in view of

body coloration and structure of male hypopygium. This species was recorded also by Tokunaga (1940) from Sakhalin. However, the present species is unusual as a member of this group in that it has only 10 segments of antennal flagellum, low AR value of 0.43, and setae on appendage 2-a are all simple (in *Cladotanytarsus*, these are branched and lamellar). The body size is much smaller than reported with *C. van-der-wulpi*, which has the wing length of 2 mm (only 1 mm in the present species).

(10) *Tanytarsus tamadecimus*, sp. nov.

Materials studied. A male, emerged on 14 September 1979 from a sample collected at Station No. 3 of the Minamiasakawa River.

Male. (Plates 28, 29). Body length 4.05 mm. Wing length 2.48 mm. Body coloration generally brown, scutal stripes and postnotum dark brown. Head as in Fig. 28-B. Antennal flagellum 13 segmented, AR 1.00. Palpi 4 segmented (41, 116, 147, 220 microns). Eyes with a long dorsomedial projection, 38 microns distant from each other and 65 microns high, ER 0.58. Frontal tubercles 13 microns high and 8 microns wide at the base (Fig. 28-C). Supraorbital setae 8 on each side. Clypeal setae 12.

Scutum with only 4 dorsomedian setae (so far as I could make out with the laterally mounted specimen), 6 dorsolateral setae and 1 supra-alar seta on each side. Scutellum with only 4 setae. Wing as in Fig. 28-A and Table 1-10. Wing membrane with macrotrichiae only in the distal half, basal portions of cell R-M, cell M-Cu and cell Cu bare, and without hairs behind Cu vein. R 1 and R 4+5 running close together, R 2+3 separated from both veins (in *Rheotanytarsus* R 2+3 is usually missing). fCu much beyond r-m. Legs almost uniformly brown, relative length of leg segments as in Table 2-10. LR of front leg 1.81. Femora, tibiae and tarsi I with relatively long hairs, fBR 3.0, mBR 4.2, hBR 3.2. Front tibia with a sharply pointed terminal scale (Fig. 28-D). Terminal comb scales of middle and hind tibiae separated, and both with a long spur (Fig. 28-E). Pulvilli absent.

Hypopygium as in Figs. 29-A, B. Bands of anal tergite dark, and separated in the middle. Anal point parallel-sided and apically rounded, with 10 spine clusters between lateral ridges, with several lateral hairs, and 5 short hairs at the base (Fig. 29-D). Appendage 1 with a beak-like posterior process, with 2 setae on inner margin, 7 setae on dorsal and lateral sides, and 1 long seta on the ventral side arising from a long tubercle; appendage 1-a composed of a long and spatulated dorsal process, and a ventral hook-like process connected with each other (Figs. 29-F, G). Appendage 2 stout and short, with microtrichiae all over the surface, and with 11 subterminal recurved setae on dorsal side and 4 terminal setae on the ventral side; appendage 2-a short, with broad and simple setae (Fig. 29-E). Gonocoxite rather slender and concave medially, apically not abruptly narrowed but ending truncate (Fig. 29-C).

Discussion. The structure of male hypopygium of the present species suggests that it belongs to the *chineyensis*-group of the genus *Tanytarsus* as defined by Reiss & Fittkau (1971), since the anal point has a well developed lateral ridges and some 10 spine clusters, anal tergite bands are separated in the middle, and appendage 2-a is short and bears simple lamellar setae. However, the shape and structure of appendages 1 and 1-a is quite unique; 1 has a beak-like caudal projection, and 1-a is composed of a long spatulated dorsal process and a hook-like ventral process connected with each other. This structure is

probably a modification of the twisted type of appendage 1-a such as seen in *Tanytarsus brundini* Lindberg and *T. tamaoctavus* newly described in this paper.

(11) *Tanytarsus tamaundecimus*, sp. nov.

Materials studied. Two males (No. A 43:91 & 92), emerged on 3 September 1979, from bottom sample collected at Station No. 3 of the Minamiasakawa River, 17 August. A female (No. A 43:93) same data. 3 pupal exuviae (2 males and 1 female), collected from water surface of the same rearing tub on the same date. All mounted in gum-chloral.

Male. (Plates 30, 31). Body length 2.41 and 2.66 mm. Wing length 1.47 and 1.50 mm. Body coloration almost uniformly pale yellow, scutal stripes and postnotum yellowish brown. Antennal flagellum 13 segmented, AR 0.77 and 0.72. Palpi 4 segmented (29, 118; 121, 205 microns). Dorsomedial projection of eyes moderately developed, ER 0.44 and 0.65. Frontal tubercles conical, 31 microns high and 19 microns in diameter at the base, 53 microns apart from each other (Fig. 30-C). Supraorbital setae 8 or 9 on one side. Clypeal setae 13 or 14.

Scutum with 12 dorsomedian setae, 8 dorsolateral setae and 1 supra-alar seta on each side. Scutellum with 4 or 5 setae. Wing as in Fig. 30-A and Table 1-11. Squama bare. Macrotrichiae on wing membrane rather scanty, those between M and Cu are mostly on a single row except for the marginal area. R 4+5 ending distal to tip of Cu 1. fCu beyond r-m. Relative length of leg segments as in Table 2-11. fLR 3.28. Terminal scale of front tibia long and sharply pointed (Fig. 31-C). Terminal comb scales of middle and hind tibiae separated, and both with a long spur (Fig. 31-D). fBR 3.3, mBR 9.4, hBR 5.3. Middle and hind femora and tibiae also with long hairs. Pulvilli absent.

Hypopygium as in Fig. 31-A. Ninth tergite with 3 short hairs near base of anal point. Bands of ninth tergite separated in the middle. Anal point short and stout, triangular in shape, with 6 spine clusters between well developed lateral ridges, and 5 lateral hairs on each side (Fig. 31-E). Appendage 1 30 microns long and 15 microns wide, roughly egg-shaped, with 2 hairs on the inner margin, 3 hairs on the lateral margin, and 1 stout hair on the ventral side near base of appendage 1-a; appendage 1-a 18 microns long and 4 microns wide, extending beyond inner margin of appendage 1, curved inwards near the tip and with rather pointed apex (Figs. 31-G, H). Appendage 2 65 microns long, slightly expanded apically, with 12 or 13 recurved setae in the apical portion; appendage 2-a 28 microns long, with less than 10 long, stout and simple setae, the apical setae about 25 microns long and extending much beyond appendage 1 but not reaching to tip of appendage 2 (Fig. 31-F). Gonostylus as in Fig. 31-B.

Female. (Plate 30). Body length 1.70 mm. Wing length 1.52 mm. Coloration as in the male, almost uniformly pale yellow, scutal stripes brownish yellow. Antenna 5 segmented (48, 77, 55, 67, 150 microns; Fig. 30-H); last antennal segment with 5 subterminal sensory setae. Palpi 4 segmented (31, 108, 111, 183 microns; Fig. 30-G). Frontal tubercles conical, 27 microns high and 34 microns in diameter (wider than that of the male) and 100 microns distant from each other (Fig. 30-D). Supraorbital setae 6 on one side. Clypeal setae 18.

Scutum with 12 dorsomedian setae, 10 dorsolateral setae on one side and 12 on the other, one supra-alar seta on each side. Scutellum with only 3 setae. Wing as in Fig. 30-A and Table 1-11. Hairs more numerous than in the male wing, but still fewer than in most other *Tanytarsus* species. fLR 3.2, very high as in the male. Front tibia with a sharply pointed terminal scale (Fig. 30-E). Cercus and spermathecae as in Figs. 30-I, J.

Pupa. (Plate 32). Length of abdomen 2.3 and 2.4 mm in the two male pupal exuviae, and 2.5 mm in the female specimen. Thoracic respiratory organs (Fig. 32-A) simple and filamentous, rectangularly curved near the middle, with minute spinules on the distal half, length 0.30-0.33 mm. Distribution of spines and spinules on abdominal segments characteristic to this species, as in Figs. 32-B, C. Tergite II with a proximal spinose area united in the middle (II-b), distal spinose areas contiguous to it but separated in the middle and slightly pigmented, and a caudal transverse row of 48-54 recurved hooks (II-d). Tergites III with a pair of longitudinal rows of 53-66 long spines, their base lines being medially convex. Tergite IV with a pair of rows of 117-150 long spines, their bases being laterally convex. Tergites V and VI with a pair of ovoid and pigmented spine patches bearing short spines in the proximal half of the segment (V-a, VI-a). Segments VIII and IX with a pair of proximal spinulose areas. The number of lateral hairs are 3 pairs on segments II to VI, 4 pairs on segment VII, and 5 pairs on segment VIII, among which only the caudal 2 pairs on segment VII and all 5 pairs on VIII are long and filamentous, the others being short and simple. Caudolateral scales of segment VIII bear a transverse row of about 6 spines, and 7 or 8 additional spines on the ventral surface (Fig. 32-D). Anal lobes fringed with 38-42 filamentous hairs, and with 2 long, filamentous hairs on the dorsal side.

Discussion. This species is apparently most closely related in the structure of male hypopygium and pupal chaetotaxy to the *Tanytarsus lestagei* complex reported from Europe, as anal point has well-developed lateral ridges and several spine clusters between them, anal tergite bands well separated, appendage 1-a long and reaches beyond inner margin of appendage 1, and appendage 2-a bears long, simple setae. In the pupa, the present species also coincides with those of *T. lestagei* complex in that abdominal segments III and IV bear a pair of longitudinal rows of long spines, V and VI with a pair of ovoid patches of short spines, and anal lobes bear 2 long hairs. Lindberg (1967) reported on the presence of at least 9 sibling species within the *T. lestagei* complex, but according to Pinder (1978, p. 154) they are not separable as individuals. The present species differs from *T. lestagei* in the body coloration (according to Edwards, 1929, scutal stripes shining black in *T. lestagei*), in that the hairs on appendage 2-a of the present species are shorter and fewer (according to Pinder, they extend beyond tip of appendage 2), AR being lower and LR being much higher in the present species (1.1-1.3, and 2.06-2.28 in *T. lestagei* according to Lindberg). In the pupa, the base of long spines on segment IV is almost straight in *T. lestagei* complex according to Lindberg, not rectangularly curved as in the present species.

(12) *Tanytarsus oyamai* Sasa, 1979

Two males emerged on 20 August, and another male on 6 September, all from samples collected at Station No. 5 of the Minamiasakawa River, 17 August 1979. Morphology of larvae, pupae and adults of this species was described in the previous paper by Sasa (1979).

II. CHIRONOMINI

(13) *Microtendipes britteni* (Edwards, 1929)

Materials studied. Altogether 11 males and 17 females emerged from samples collected on 17 August 1979, at riverbed of Station No. 3, another female from Station No. 2 of the Minamiasakawa River. Among them, 6 males and 5 females were dissected and mounted in gum-chloral (No. A 46:01 -), the others are preserved dry. Five pupal exuviae are mounted in gum-chloral, and 8 others are preserved in alcohol.

Male. (Plates 33, 34). Body length 3.85-4.90 mm (4.38 mm in average of 7). Wing length 2.50-2.71 mm (2.62 mm in average of 7). Body coloration characteristic to this species, i.e., antennal hairs yellow, antennal shaft brown, scutum shining black (slightly brownish), scutal stripes not discernible, scutellum dark brown, postnotum black, abdominal tergites I - V greenish yellow, VI to VIII and hypopygium dark brown; wing membrane milky white and semi-transparent, without dark spots; halteres yellow; tip of front femur and entire segment of front tibia dark brown, knee joints of middle and hind legs dark brown, front tarsi and all the segments of middle and hind legs yellow.

Antennal flagellum 13 segmented, AR 1.87-2.05 (2.00 in average of 5). Palpi 4 segmented (58, 310, 291, 408 microns). Frontal tubercles absent. Eyes with a prominent dorsomedial projection, distance between two eyes only 77 microns and 0.09 times height of the eye. Clypeus with 14-20 hairs (16.7 in average of 6).

Anteprepronotum reduced in the middle and overhung by anterior projection of scutum, with two lateral hairs on each side. Scutum without dorsomedial setae (a characteristic of this genus), with 7-14 dorsolateral setae (9.4 in average of 7), and 3-5 (most frequently 4) supra-alar setae. Scutellum with 16-20 setae roughly in two transverse rows (Fig. 33-D). Wing membrane unmarked. Squama fringed with 11-15 setae. Wing vein as in Fig. 33-A and Table 1-13; R 2+3 running very close to R 1 (a characteristic of this genus); fCu beyond r-m. Relative length of leg segments as in Table 2-13. fLR 1.27-1.35 (1.31 in average of 6), mLR 0.59-0.67 (0.64 in average of 6), hLR 0.70-0.79 (0.73 in average of 7). Apical 15% of front femur and entire segment of front tibia, as well as knee joint (apical part of femur and proximal part of tibia) of middle and hind legs dark brown, while the rest parts of leg segments are entirely yellow. Hairs on legs are all very short, BR of front tarsus I about 2.0. Front tibia with 3 long subterminal setae, but without apical scale, ending truncate (Fig. 33-E; a characteristic of this genus). Comb scales on middle and hind tibiae contiguous or only narrowly separated, with only one spur (Fig. 33-F). Pulvilli moderately developed.

Abdominal tergites I to IV as well as basal half of V greenish yellow, distal half of V and further distal part of abdomen dark brown. Abdominal segment VIII rectangular in shape and not triangularly produced as in *Polypedilum* (Figs. 39-A, 47-C). Anal point roughly triangular, with pointed apex (Fig. 34-E). Dorsal appendage sickle-shaped, largely bare, curved inwards and apically pointed, with a long hair medially near the base, and 4 (rarely 5, 6 or 7) long hairs on the dorsolateral corner (Fig. 34-G). Ventral appendage as in Fig. 34-H, with about 20 stout and recurved hairs but without long apical hair such as seen in most *Polypedilum* species. Gonostylus as in Fig. 34-F.

Female. (Plate 33). Body length 3.28-3.59 mm (3.44 mm in average of 5 gum-chloral mounted specimens). Wing length 2.50-2.76 mm (2.66 mm in average of 6). Body coloration as in the male, i.e., scutum and postnotum shining black, scutellum dark brown,

abdominal tergites I to V greenish brown, VI to IX as well as hypopygium dark brown, halteres yellow, tip of front femur and entire segment of front tibia as well as knee joints of middle and hind legs black, rest parts of legs largely yellow. Antennal flagellum 5 segmented (segments IV and V clearly separated, 142, 92, 99, 96, 171 microns; Fig. 33-C). Palpi 4 segmented (68, 290, 291, 408 microns; Fig. 33-B). Eyes with a long dorsomedial projection, distance 78 microns, ER 0.21. No frontal tubercles. Clypeal hairs 18-21.

Scutum without dorsomedian setae, with 10-16 dorsolateral setae on each side, and 3 or 4 supra-alar setae on each side. Scutellum with 16-25 hairs roughly in two transverse rows. Relative length of leg segments as in Table 2-13. fLR 1.38-1.43 (1.41 in average of 5), mLR 0.57-0.62 (0.60 in average of 5), and hLR 0.72-0.74 (0.73 in average of 5). Other characteristics of legs as in the male. Wing venation as in Table 1-13 and Fig. 33-A. Cercus and spermathecae as in Figs. 33-G, H.

Pupa. (Plate 35). Length of abdomen of pupal exuviae 4.43-4.48 mm (4.45 mm in average of 4). Thoracic respiratory organs divided into 2 anterior branches and 5 or 6 posterior branches, the former being longer and wider than the latter (Fig. 35-A). Distribution of spines and spinules on abdominal segments as in Figs. 35-B, C. Abdominal tergite I and sternite I each with a spinulose area (this is an unusual characteristic). Tergite II with a proximal spinose area (II-a), a middle spinulose area (II-b & II-c), and an uniserial row of 70-100 (81.4 in average of 5) long recurved spines along the caudal margin, each measuring about 14 microns (II-d). Tergites III and IV similar to II in distribution of spines, but the caudal row of spines of III (III-d) much fewer (0-10 in total), while those on IV (IV-d) are 67-90 in number and distributed in 3 or 4 rows. Tergites V and VI with a proximal spinose area and a middle spinulose area, but without spines along the caudal margin. Tergites VII and VIII with 3 spinulose areas. Sternites I to VIII all with spinulose areas, as in Fig. 35-B. In addition, sternite IV has a pair of caudolateral whirl-like spinose areas. Caudolateral scales on VIII composed of a stout and sharply pointed spine, and 2 or 3 accessory spines along the lateral margin (Fig. 35-D). Segments II to IV with 3 pairs of short lateral hairs; V with 3 pairs, VI and VII with 4 pairs, and VIII with 5 pairs of long filamentous hairs on the lateral margins. Anal lobes fringed with 30-42 (37.7 in average of 7) filamentous hairs, and without dorsal hairs.

Discussion. Adults of this species is quite characteristic in the body coloration, i.e., dark thorax, greenish yellow abdomen, black front tibia, and yellow color of rest of the leg segments. The shape and structure of anal point, dorsal and ventral appendages are also very unique and can be easily differentiated from 3 species of *Microtendipes* described by Tokunaga (1940) from Karahuto and Kyoto. Because the morphological characteristics observed with the present materials agreed with those described as *M. britteni* (Edwards) by Edwards (1929), Goetghebuer (1937) and Pinder (1978) with European specimens, the present species is tentatively described here under the same name, though future more detailed studies may indicate that the two populations be different.

Adult of the present species is similar in many characteristics to genus *Polypedilum*, but differs from it in the shape of abdominal segment VIII (nearly rectangular and not triangular as in *Polypedilum*), in the absence of terminal scale of front tibia, absence of dorsomedial setae of scutum, and in the structure of comb scales on middle and hind tibiae.

Pupa of this species differs from most other related species in having spinulose areas

on all of tergites and sternites of abdominal segments, in the fewer numbers of caudal spines on tergite III, and in the numbers and characteristics of lateral hairs. Structure of caudolateral scales on VIII and of thoracic respiratory organs are also characteristic to this species.

(14) *Polypedilum takaoense*, sp. nov.

Materials studied. Holotype: a male (No. A 45:01), emerged in the laboratory on 22 August 1979 from a sample collected 17 August at Station No. 1 of the Minamiasakawa River. Paratype: a female (A 45:02), emerged on 23 August, from the same sample.

Male. (Plates 36, 37). Body length 3.06 mm. Wing length 1.63 mm. Body coloration almost uniformly yellow, with the exceptions of antenna and palp, which are brown, eyes, which are dark brown, and scutal stripes, which are yellowish brown. Wings unmarked. Antennal flagellum 13 segmented, AR 1.20. Eyes bare, each with a long dorsomedial projection, 275 microns high and 76 microns apart from each other, ER 0.28. Frontal tubercles absent. Palpi 4 segmented (41, 118, 121, 205 microns). Supra-orbital setae 11 on each side. Clypeal setae 12. Scutum with 16 dorsomedian setae, 12 dorsolateral setae on each side, and 4 supra-alar setae on each side. Scutellum with an anterior row of 4 short setae and a middle row of 10 longer setae. Pronotum reduced in the middle and overhung by scutum. Squama fringed with 10 hairs. Wing membrane bare, without clouds and dark spots, venation as in Fig. 36-A and Table 1-14. R 2+3 is closer to R 1 than to R 4+5. fCu much beyond r-m. Relative length of leg segments as in Table 2-14; fLR 1.77. Front tibia with a rounded terminal scale (Fig. 36-C). Combs of middle and hind tibiae separated, one with a long spur and the other unarmed (Fig. 36-D). Pulvilli well developed.

8th abdominal tergum roughly triangular, constricted in the middle (Fig. 37-A). Male hypopygium with an anal point, which is slender, parallel-sided, and apically rounded (Fig. 37-B). Dorsal appendage long, slender and strongly curved, without setigerous area and with a long hair (Fig. 37-C). Ventral appendage slightly expanded apically, with about 15 recurved setae and one long apical hair (Fig. 37-D). Gonostylus tapering towards apex, with a row of long setae along the inner margin (Figs. 37-A, E).

Female. (Plate 36). Wing length 1.97 mm. Body coloration as in the male, almost uniformly pale yellow with the exception of eyes (dark brown), antenna, palpi and scutal stripes (brown). Antenna 6 segmented (75, 135, 82, 96, 55, 166 microns; the last and the preceding segments are only incompletely separated), with 3 subterminal setae (195, 193, 181 microns; Fig. 36-B). ER 0.20. Supraorbital setae 12 on one side. Clypeal setae 22. Scutum with 24 dorsomedian setae, 20 dorsolateral setae on each side, and 5 supra-alar setae on each side. Scutellum with an anterior row of 5 setae and a posterior row of 14 setae. Wing venation as in Fig. 36-A and Table 1-14. Relative length of leg segments as in Table 2-14, fLR 1.82, mLR 0.55, hLR 0.75. Front tibia with a rounded terminal scale (Fig. 36-E). Middle and hind tibiae with two separated combs, the narrower one with a long spur, the other unarmed (Fig. 36-F). Cercus and spermatheca as in Figs. 36-G, H.

Discussion. This species is a typical member of genus *Polypedilum* since its 8th abdominal segment of male is triangular, terminal comb scales of middle and hind tibiae are separated and only one of them bears a spur, ventral appendage of male hypopygium has a long terminal seta, and squama is fringed with long hairs. Among the previously

described species of this genus, the present species is apparently closest to *P. flavescens* (Johannsen, 1932), since the body coloration is almost uniformly yellow, and wings are unmarked. However, *P. flavescens* differs from the present species in that dorsal appendage is only slightly curved and has a terminal knob, and with a long seta on the inner side; ventral appendage of *P. flavescens* has only "several" subterminal hairs; the terminal scale of front tibia is also different (pointed in *P. flavescens*) and fLR is higher in *P. flavescens* (about 2.0).

(15) *Polypedilum unifascium* (Tokunaga, 1938)

This species was described by Tokunaga (1938, p. 335) only by female collected by light at Yamashina, Kyoto.

Materials studied. A total of 12 males and 5 females were reared from samples collected from riverbed of Station No. 1 and No. 2 of the Minamiasakawa River, 17 August 1979, together with pupal exuviae. 7 males, 2 females and 5 pupal exuviae were mounted in gum-chloral (No. A 45:31-36, 41-43; 46-50, respectively). The rest adults are preserved dry, and pupal exuviae in alcohol.

Male. (Plates 38, 39). Body length 1.85-2.36 mm (2.23 mm in average of 5). Wing length 1.33-1.46 mm (1.37 mm in average of 7). Body coloration: antennal hairs yellow, shaft brown; scutum yellow, scutal stripes brown, scutellum brown, postnotum dark brown, halteres yellow, wing membrane white, with dark marks as in Fig. 38-A; legs yellow excepting basal two thirds of femora which is brown; abdominal tergites dark brown.

Antennal flagellum 13 segmented, the last segment relatively short, AR 0.58-0.66 (0.62 in average of 5). Palpi 4 segmented (31, 65, 84, 128 microns). Frontal tubercles absent. Eyes with a long dorsomedial projections, only narrowly separated from each other, the distance between two eyes 34 microns, ER 0.16.

Scutum with about 16 dorsomedian setae, 16 dorsolateral setae on each side, and 4 supra-alar setae on each side. Scutellum with 8 setae in a transverse row. Wing membrane with two dark stripes as in Fig. 38-A. Squama fringed with 4-6 hairs. Wing venation as in Fig. 38-A and Table 1-15. R 2+3 ending closer to end of R 1 than to R 4+5. fCu far beyond r-m. Legs almost uniformly yellow, excepting basal two thirds of femora brown, and distal segments of tarsi darker than tibiae. fLR 1.75-1.96 (1.87 in average of 5), mLR 0.56-0.61 (0.58 in average of 5), hLR 0.66-0.74 (0.71 in average of 5). Terminal scale of front tibia with pointed apex (Figs. 39-F, G). Middle and hind tibiae with two separated terminal comb scales, one with a long spur, and another unarmed (Figs. 39-H). All legs with well developed pulvilli.

Abdominal tergites VIII, IX and hypopygium as in Fig. 39-A. Base of tergite VIII narrowed towards the middle (a characteristic of genus *Polypedilum*). Tergite IX with a pair of long and narrow tubercles flanking the anal point (Fig. 39-C; a determinative feature of subgenus *Tripodura*). Dorsal appendage pad-like, without horn-like bare process such as seen in most other members of this genus, covered thickly with short hairs, and bears a long hair on the lateral margin (Fig. 39-E). Ventral appendage long and slender, without apical swelling, bears a long terminal hair directed caudally, and about 15 stout and recurved hairs (Fig. 39-D). Gonostylus as in Fig. 39-B, with 6 long hairs along the inner margin and one terminal hair.

Female. (Plate 38). Body length of two gum-chloral mounted specimens 1.74 and 1.85 mm, respectively. Wing length 1.31-1.38 mm (1.34 mm in average of 4). Body coloration darker in general than in the male, ground color of scutum brown, and scutal stripes dark brown. Antennae 6 segmented (58, 96, 63, 75, 57, 104 microns), with two long subterminal hairs 130 and 135 microns long (Fig. 38-C). Palpi 4 segmented (29, 65, 92, 149 microns; Fig. 38-B). Frontal tubercles absent. Eyes with a prominent dorsomedial projection as in male, only 39 microns apart from each other, the distance being 0.17 times the height of eye. Wing as in Fig. 38-A and Table 1-15, with two conspicuous dark bands. Relative length of leg segments as in Table 2-15; front leg ratio very high as in male, 1.92 in a mounted specimen. Cercus roughly pentagonal, 63 microns wide and 60 microns long, ratio 1.05, and with relatively small numbers of long hairs along the distal margin, as in Fig. 38-H. Spermathecae as in Fig. 38-G.

Pupa. (Plate 40). Length of abdomen 2.48-2.61 mm (2.55 mm in average of 5). Thoracic respiratory organs divided into 4 anterior and 4 posterior branches (Fig. 40-A). Distribution of spines and spinules on abdominal segments as follows (Figs. 40-B, C). Tergite I without spines and spinules; sternite I with a central spinulose area (I-v). Tergite II with a proximal transverse band of spines (II-a), a large central spinose area (II-b) and an uniserial transverse band of 38-42 recurved spines along the caudal margin (II-d); sternite II with a central spinulose area. Tergite III with a proximal band of spines (III-a), a large central spinose area (III-b), and a transverse row of small spines in multiple rows along the caudal margin (III-d); sternite III with a reversed U-shaped band of long spines, each 22-28 microns long (III-v). Tergite IV with three spinose areas, as in tergite III; sternite IV with a pair of small spine groups, each composed of 4 long spines (IV-v), and a pair of whirl-like spinose areas in the caudolateral corners (IV-w). Tergite V with a proximal band of spines and a large central spinose area, but the caudal spinose area is absent; sternite V with a caudolateral spinulose zone (V-w). Tergite VI with a small proximal spinose area and a distal spinose area. Tergite VII and VIII with a pair of small proximal spinulose areas. Sternite VIII with a pair of small spinulose areas. Caudolateral scales of segment VIII composed of a main and 3 or 4 accessory spines (Fig. 40-D). Segments II to VI with 3 pairs of lateral hairs, and VII and VIII with 4 pairs of lateral hairs; those on segments II to IV are short and simple, while those on V to VIII are long and filamentous (Fig. 40-B, Table 3-15). Anal lobes with a simple hair on dorsal side, and each fringed with 18-23 (21.0 in average of 8 hairs) long filamentous hairs.

Discussion. The present species is tentatively identified as *Polypedilum unifascium* (Tokunaga, 1938), because morphological characteristics of female is almost identical with that of the original description by Tokunaga (1938). However, the shape and distribution of hairs of female cerci are somewhat different from that figured by Tokunaga (1938, p. 335, Fig. 15-b), being more rounded and bear less hairs in the present specimens than the original ones. Males and pupae of *P. unifascium* have remained unknown. The structure of male hypopygium is typical of subgenus *Tripodura* proposed by Towns (1945), since ninth tergite bears a pair of prominent tubercles on both sides of anal point, and dorsal appendage is broad, pad-like, covered thickly by short hairs, bears two long hairs, and without bare and pointed apical process. Male of this species is characterised by the small value of antennal ratio (0.58-0.66). The pattern of dark marks on the wing is characteristic to both male and female of this species. In pupa, presence of reversed U-shaped band of long and narrow spines on abdominal sternite III is a distinctive characteristic, together with the structure of thoracic respiratory organs, which is branched into

8 tubes. Among the chironomid species known from Europe, this species is most closely related to *Polypedilum apfelbecki* (Strobl) in the structure of male hypopygium, but differs from it in the wing patterns and the body coloration.

(16) *Polypedilum (Polypedilum) asakawaense*, sp. nov.

Materials studied. Holotype: a male, emerged 12 Sept. 1979 from bottom samples collected at Station No. 3 of the Minamiasakawa River on 17 Sept. (No. A 45:21). Paratypes: a male and two females, emerged 14 Sept. from the same sample and mounted in gum-chloral; a male, emerged 11 Sept., fixed on pin. A pupal exuviae collected 14 Sept. (No. A 45:21-25).

Male. (Plates 41, 42). Body length 3.76 and 3.82 mm in the two gum-chloral mounted specimens. Wing length 1.97, 2.05 and 2.11 mm. Antennal flagellum dark brown or nearly black. Scutum and scutellum brownish yellow, scutal stripes reddish yellow, halteres yellow, postnotum dark brown, abdomen almost uniformly black; wings unmarked; legs almost uniformly pale yellow (this coloration is characteristic to this species).

Antennal flagellum with 12 segments only, AR 1.80 and 1.92. Palpi 4 segmented (53, 128, 142, 241 microns). Eyes with a narrow and long dorsomedial projection, the distance between two eyes 87 microns and 0.26 times the height of eye (Fig. 41-D). Supraorbital setae 10 on each side. Clypeal setae 29.

Scutum with 9-12 dorsomedian setae, 11 dorsolateral setae on each side, and 3 supra-alar setae on each side. Scutellum with 8 setae in a transverse row. Wings unmarked, with very faint clouds when seen under reflecting light. Squama fringed with about 10 hairs. Wing venation as in Fig. 41-A and Table 1-16. R 2+3 closer to R 1 than to R 4+5. fCu much beyond r-m. Cu 2 curved near tip. Relative length of leg segments as in Table 2-16. fLR 1.72, mLR 0.60, hLR 0.74. Front tarsi without long hairs, but femora, tibiae, tarsi I, II and III of middle and hind legs with long hairs (those on hind tarsus I measure 198 microns and 7.5 times the diameter of the segment). Pulvilli well developed, deeply bifid. Front tibia has a broad terminal scale with a pointed tip (Fig. 42-C). Terminal comb scales of middle and hind tibiae are separated, the narrower one with a long spur, and the wider one unarmed (Fig. 42-D).

Eighth abdominal tergite narrowed basally and nearly triangular (Fig. 42-A). Hypopygium as in Fig. 42-B. Anal point roughly triangular, basally setigerous, and with lateral hairs (Fig. 42-F). Dorsal appendage is characteristic to this species, long, slender and rectangularly curved in the middle, entirely bare, and with rounded apex (Fig. 42-G). Ventral appendage gradually tapering towards apex, with about 16 recurved hairs and a long terminal hair about 85 microns long (Fig. 42-H). Gonostylus not abruptly narrowed and apically rather sharply pointed, with a terminal seta and long setae along the inner margin (Fig. 42-E).

Female. (Plates 41, 42). Wing length 2.16 and 2.15 in the two specimens. Body coloration as in the male, i.e., antennal flagellum black, scutum brownish yellow with scutal stripes reddish brown. Halteres mostly yellow with the tip brown. Scutellum yellow, postnotum dark brown, abdominal tergites black, legs yellow and without dark rings. Antenna with a pedicel and 5 segments of flagellum (70, 111, 84, 96, 72, 159 microns), the last segment completely separated from the preceding ones and bears 3 long

subterminal setae of subequal length (169, 178, 164 microns, Fig. 41-C). Palpi 4 segmented (53, 130, 137, 287 microns, Fig. 41-B). Eyes highly developed, occupying the largest part of head and with a long dorsomedial projection, the distance between two eyes being only 30 microns and 0.08 times the height of the eye. Supraorbital setae 10 on each side. Clypeal setae 30.

Scutum with 9-12 dorsomedian setae, 14 or 16 dorsolateral setae on each side, and 3 supra-alar setae on each side. Scutellum with 14 or 12 setae. Wing venation as in Fig. 41-A and Table 1-16. Squama fringed with 12 hairs. R 2+3 much closer to R 1 than to R 4+5. fCu far beyond r-m. Relative length of leg segments as in Table 2-16. LR 1.82 in the front leg, 0.56 in the middle leg, and 0.76 in the hind leg. Front tibia has a broad terminal scale with pointed apex (Fig. 41-E). Terminal comb scales of middle and hind tibiae separated, one has a spur (Fig. 41-F). Pulvilli well developed (Fig. 42-I). Cercus and spermathecae as in Figs. 41-G, H.

Pupa. (Plate 43). Length of abdomen 3.78 mm (a pupal exuviae mounted in gum-chloral). Thoracic respiratory organ divided into 6 tubes (Fig. 43-A). Distribution of spines and spinules on abdominal segments as in Figs. 43-B, C. Segment I without spines and spinules. Tergite II with a proximal spinose area (II-a), with a middle spinulose area (II-b & II-c), and an uniserial transverse row of 45 large recurved spines, each about 25 microns long along caudal margin (II-d); sternite II with a large spinulose area. Tergite III and IV similar to II, but the spines on caudal margin (III-d & IV-d) smaller and more numerous (104 and 105, respectively), in 3 or 4 rows; sternite III with a large spinulose area, IV with a pair of caudolateral whirl-like spinose areas (IV-w). Tergites V and VI with a basal spinose area and central spinulose areas, but without spines on caudal margin. Tergite VII with a pair of small proximal spinulose areas composed of several small spinules (VII-a), Sternites VI, VII and VIII with a pair of proximal spinulose areas (VI-v, VII-v & VIII-v). Segments II to VI with 3 pairs of lateral hairs, and VII and VIII with 4 pairs of lateral hairs; those on V to VIII are long and filamentous swimming hairs (Table 3-16). Caudolateral scales on VIII dark brown, sharply pointed, and with one or two small spines on the lateral margins (Fig. 43-D). Anal lobes fringed with 38 and 41 long, filamentous hairs.

Discussion. This species is also a typical member of subgenus *Polypedilum* in the strict sense, as front tibia has a terminal scale with rounded margin, terminal comb scales of middle and hind tibiae are separated and with a long spur only on one of them, abdominal tergite VIII with a triangular base, and vein R 2+3 is separated from R 1. Ventral appendage is also characteristic to this subgenus in having a long terminal hair. Among this subgenus, the present species belongs to a group with unmarked wings. Until now, 3 species have been recorded from Japan, i.e., *Polypedilum kyotoense* (Tokunaga, 1938), *P. ureshinoense* (Sasa, 1979) and *P. tsukubaense* (Sasa, 1979). The last two species was described as *Microtendipes*, but should be revised as to belong to genus *Polypedilum* s. str. The present species is unique and quite different from those already described ones in body coloration, in the number of segments of antennal flagellum (12 in the present species, 13 in others), and in the shape of anal point (triangular in *asakawaense*, parallel-sided in others), and in the structure of dorsal appendage (long, slender and rectangularly curved, and entirely bare in *asakawaense*, while the other species have one or several long hairs, or with setigerous base).

The pupal exuviae was found co-existent with those of *Microtendipes britteni*, but

was differentiated by the shape of thoracic respiratory organs, by the number of spines on intersegmental membrane of abdominal tergite III (more than 100 in this species, less than 20 in *M. britteni*), by the number of filamentous lateral hairs on abdominal segment VIII (4 in the present species, 5 in *M. britteni*), and by color and structure of caudolateral scales on segment VIII (darker in this species, lateral spines smaller in this species).

(17) *Polypedilum (Polypedilum) tamagoryoense*, sp. nov.

Materials studied. Holotype: a male, emerged 18 Sept. 1979, from a sample collected at Station No. 5 (under the bridge of Tama-Goryo), the Minamiasakawa River, 17 August 1979, first examined on pin and later mounted in gum-chloral (No. A 45:11), Paratypes: a male, emerged 11 Sept., from the same sample, mounted in gum-chloral (No. A 45:12); a female, same data, first fixed on pin, later mounted in gum-chloral (No. A 45:13).

Male. (Plates 44, 45). Wing length 2.30 mm (holotype) and 2.22 mm. Body length 4.10 and 3.77 mm. Ground color of scutum dark brown, scutal stripes black, scutellum, postnotum and abdomen dark brown (nearly black), halteres yellow, leg segments all yellow. Wing membrane milky white, with faint clouds, as in Fig. 44-A. Antennal flagellum with 13 segments, AR 1.65 and 1.55. Palpi 4 segmented (51, 142, 149, 231 microns). Eyes with a prominent dorsomedial projection, 155 microns distant from each other, 0.41 the height of eye. Frontal tubercles absent.

Anteprepronotum reduced in the middle, with 2 or 3 lateral hairs on each side. Scutum with 18 dorsomedian setae, 18 dorsolateral setae on each side, and 10 supra-alar setae on each side. Scutellum with 16 setae in irregular rows. Squama fringed with 16 setae. Wing venation as in Fig. 44-A and Table 1-17. R 2+3 separated from R 1. fCu beyond r-m. Wing membrane with faint clouds between R 4+5 and M, Cu 1 and Cu 2, and along the posterior margin. Relative length of leg segments as in Table 2-17. Terminal scale of front tibia broad, and with slightly pointed apex (Fig. 44-D). Comb scales on middle and hind tibiae separated, one with a long spur and the other without spur. Tarsus I of all legs with relatively long beards, BR of front, middle and hind tarsus I being 3.5, 4.6 and 6.1, respectively. Pulvilli well developed.

Abdominal tergite VIII with a triangular base (Fig. 45-A). Hypopygium as in Fig. 45-A. Anal point slender, posterior margin of ninth tergite without tubercles (Fig. 45-B). Dorsal appendage curved and slender, without microtrichiae, and bears one long hair (100 microns long) on the posterior margin (Fig. 45-C). Ventral appendage slender, distal half slightly expanded, with one long terminal hair directed backwards (170 microns long) and 9-11 long, curved hairs directed forwards (Fig. 45-D). Gonostylus with a rather rounded apex, with 5 very long hairs and 6 shorter hairs along the inner margin and 3 hairs subapically (Fig. 45-E).

Note: Because front tarsi and distal two segments of palpi and antennae are missing from the female specimen, it will be described when more materials are collected.

Discussion. This species is a typical member of subgenus *Polypedilum* s. str., but quite peculiar in the body coloration (black thorax and abdomen, yellow halteres and legs), in wing marks (presence of faint clouds), in the presence of long hairs on tibiae and tarsi, and in the structure of anal point, dorsal appendage, ventral appendage, and gonostylus. Among the species of this subgenus recorded from Japan, the present species is

most closely related to *Chironomus (Polypedium) nubeculosus* Meigen described by Tokunaga (1940) from Tokyo and Karahuto, but its dorsal appendages are almost straight and not strongly curved as in the present species, it has no tarsal beards, and its AR is about 1.0. I could not find any species in the literatures showing such a combination of unique characteristics.

(18) *Polypedium ureshinoense* (Sasa, 1979)

This was described as a new species by Sasa (1979) by the name of *Microtendipes ureshinoensis*, based on one male, one female, two pupal exuviae associated with the adults, and two larvae, obtained from bottom sediments of a sewage ditch in the hot spring town Ureshino, Saga Prefecture, Kyushu. A total of 19 males and 17 females of obviously the same species were reared from bottom samples collected at Stations Nos. 5 and 6, the most polluted parts of the river at this survey, and associated pupal exuviae and larvae were found in the same samples. Adults, pupae and larvae are redescribed based on the new materials collected from the Minamiasakawa River.

Materials studied. 8 males, 5 females, 6 pupal exuviae, and 5 larvae, dissected and mounted in gum-chloral (No. A 45:51 - 78). 3 males and 3 females, fixed on pin.

Male. (Plates 46, 47). Body length 3.05-3.58 mm (3.29 ± 0.17 mm in measurements of 7 gum-chloral mounted specimens). Wing length 1.83-2.08 mm (1.99 ± 0.06 mm in measurements of 8 dry-preserved specimens). Body coloration: antennal flagellum brown, eyes dark brown, scutum yellow, scutal stripes inconspicuous and slightly reddish yellow, scutellum yellow, postnotum brownish yellow, abdominal tergites greenish yellow (brownish yellow in some specimens), halteres pale yellow, legs largely yellow, front tarsi brown.

Antennal flagellum 13 segmented, AR 1.63-1.85 (1.74 ± 0.08 in 6). Palpi 5 segmented (34, 55, 101, 104, 198 microns). Eyes with a long dorsomedial projection, ER 0.21-0.34 (0.264 in average of 5). Frontal tubercles absent. Supraorbital setae 8 on each side. Clypeal hairs 15. Scutum with 12-14 dorsomedian setae distributed along the anterior half of the midline, 14-16 dorsolateral setae on each side, and 5-6 prealar setae on each side (Fig. 46-D). Wing membrane uniformly semitransparent, without clouds and colored spots. Squama fringed with some 12 hairs. Wing venation as in Fig. 46-A and Table 1-18. R 2+3 close to R 1 and running almost parallel to it. fCu far beyond r-m. Relative length of leg segments as in Table 2-18. LR of front leg 1.68-1.85 (1.76 ± 0.07 in measurements of 6). Front tibia has a terminal scale with narrow and sharply pointed apex (Fig. 47-A). Front tarsi without beards, but tibiae and tarsi I to III of middle and hind legs with long hairs. Pulvilli well developed.

Eighth abdominal tergite roughly triangular and basally constricted in the middle (Fig. 47-C). Anal point wider at base than near the apex, with rather truncate end (Fig. 47-D). Anterior margin of anal tergite rounded, without lobes such as seen in the *Tripodura* group. Dorsal appendage composed of a bare, horn-like inner process, and a setigerous pad extending beyond the inner process as a posterior lobe; the latter bears 2 or 3 terminal setae and two basal setae (Figs. 47-G, H). Ventral appendage has a straight inner margin and concave lateral margin, bears 14-16 stout and recurved setae on the distal expanded portion and one long terminal seta 65 microns long and about half as long as the ventral appendage; (Fig. 47-F). Gonocoxite with about 10 long hairs in two

rows along the inner margin, and a terminal and 3 subterminal hairs (Fig. 47-E).

Female. (Plate 46). Body length 2.24-2.71 mm (2.40 mm in average of 5 gum-chloral mounted specimens). Wing length 1.79-2.21 mm (1.95 ± 0.14 mm in measurements of 11 dry preserved specimens). Body coloration as in the male, i.e., ground color of scutum, scutellum and leg segments mostly yellow, scutal stripes reddish yellow, halteres yellow except for the tip which is brown, postnotum and abdominal tergites brown. Antennae 5 segmented (pedicelum and 4 flagellar segments, the apical tubular portion and the basal globular portion of the last segment not divided; 94, 128, 84, 96, 212 microns; Fig. 46-B), last segment with 3 long subterminal hairs (174, 160, 188 microns; omitted from the figure). Palpi 5 segmented (67, 51, 108, 121, 236 microns; Fig. 46-C). Frontal tubercles absent. Eyes with a long dorsomedial projection, the distance being 58 microns and 0.18 times the height of eye. Distribution of dorsal hairs on scutum as in Fig. 46-E; scutum with about 12 dorsomedian setae, 25 dorsolateral setae on each side, and 6 supralar setae on each side. Wing venation as in Fig. 46-A and Table 1-18. Wing membrane unmarked. Relative length of leg segments as in Table 2-18; fLR 1.68-1.82 (1.76 in average of 5). Front tibia has a terminal scale with pointed apex (Fig. 46-F). Pulvilli highly developed. Cercus and spermathecae as in Figs. 46-G, H.

Pupa. (Plate 48). Length of abdomen 3.13-3.70 mm (3.34 mm in average of 5 pupal exuviae mounted in gum-chloral). Thoracic respiratory organs divided into 6 tube-like branches (Fig. 48-A). Distribution of spines, spinules and lateral hairs on abdominal tergites as in Figs. 48-B, C. Abdominal segment I without spines and spinules. Tergite II with a proximal transverse band of large spines (largest one 22 microns long; II-a), a second transverse band of small spines and spinules (the largest spine 8 microns long; II-b), a third transverse band of small spines (II-c), and a uniserial transverse band of about 50 large recurved spines on the intersegmental membrane (II-d; Fig. 48-C). Tergites II and IV similar to II. Tergites V and VI each with the spine bands a, b, and c, but d is absent. Tergites VII and VIII with a pair of proximal spinulous areas. Sternite IV has a pair of whirl-like spinose areas on the caudolateral corners (Fig. IV-v). The number of lateral hairs is 3 pairs in segment II to VI, and 4 in VII and VIII; those on segments II to IV are short and narrow, but those on the more caudal segments are long and filamentous (Table 3-18). Caudolateral scales on segment VIII with a sharply pointed spine, and 2 or 3 accessory spines (Fig. 48-D). Anal lobes are fringed with 29-41 (34.3 in average of 5 pairs) filamentous hairs.

Larva. (Plate 49). Body length 4.53-5.21 mm (4.87 mm in average of 5 gum-chloral mounted mature larvae). Color in life pink. Eye spots fused. Antenna (Fig. 49-E) mounted on semiglobular tubercle, 5 segmented (65, 19, 9, 10, 5 microns), segment I about 1.5 times as long as the combined length of segments II to V, and segment II shorter than the last three combined. Antennal blade 50 microns long and 1.15 times as long as combined length of antennal segments II to V. Lauterborn's organ vestigial. Labial plate (Fig. 49-A) with 14 teeth, the median pair highest and widest; the second pair much lower and narrower than the first pair; the third pair higher and wider than the second, and almost as wide as the first pair; all teeth with rather sharply pointed apex. Paralabial plates (Fig. 49-A) fan-shaped and striated, 86 microns wide and 41 microns long. Mandible with 5 cutting teeth (Fig. 49-B). Labrum, premandibles, epipharynx, and maxilla as in Figs. 49-C, D. Claws on anterior pseudopods as in Fig. 49-F, and those on posterior pseudopods as in Fig. 49-H. Base of preanal hair tuft semiglobular, and bears 6

long hairs and two shorter and thinner hairs (Fig. 49-G). Anal segments without blood gills and lateral processes; dorsal pair of anal gills long and constricted in the middle, the ventral pair shorter (Fig. 49-I).

Discussion. When this species was first described by Sasa (1979) with specimens collected at Ureshino, it was designated as a member of the genus *Microtendipes* of the *Polypedilum* group in wider sense, simply because the wing vein R 2+3 is running very close to R 1, and wing is unmarked. However, I now consider that this species as well as *Microtendipes tsukubaensis* Sasa, 1979 should better be treated as a member of genus *Polypedilum* in a strict sense, and to restrict the concept of the genus *Microtendipes* to the species with morphological characteristics such as discussed with *Microtendipes britteni* (Edwards) in the present paper. Among the known species of this genus, the present species is most closely related to *Polypedilum convictum* (Waker) and *P. cultellatum* Walker in the structure of male hypopygium, especially that of dorsal appendage, which is composed of a bare and horn-like apical process and a buckel-like, setigerous posterior lobe. The number of long hairs on the posterior lobe is 1 in *P. convictum*, 4 or 5 in *P. cultellatum* according to Pinder (1978), while those are 2 or 3 in the present species. The shape of ventral appendage and the mode of distribution of long setae on anal tergite is also different between the Japanese and the European species. The structure of larva and pupa also fits to the *convictum* group of Lenz (1942, 1962), but pupa of *convictum* has the thoracic respiratory organs branched into 4 (6 in the present species), and Lauterborn's organ is apparently larger than in the present species.

(19) *Chironomus kiiensis* Tokunaga, 1936

This was described as a new species by Tokunaga (1936, p. 76) by male and female collected at Seto (Wakayama). Hashimoto (1977a) reported that this species was very common in Japan, west of Kanto. Hashimoto (1977b) gave a brief account of the structure of larva. This species was commonly found at surveys made by the author in Kanto, Shikoku and Kyushu, and detailed description of adult male, adult female, pupa and larva was made by Sasa (1978). At this survey, a total of 15 males and 12 females were recovered from samples collected at Station No. 6, where the water was most polluted, but not from the upper parts of the river.

(20) *Chironomus yoshimatsui* Martin et Sublette, 1972

This species has been found by a number of workers to be commonly breeding in sewage ditches in many cities and towns in Honshu and Kyushu. Since Esaki (1932) designated the scientific name of *Chironomus dorsalis* Meigen to this species, this name has been commonly used by previous Japanese workers. Martin & Sublette (1972) examined materials collected at Yamaguchi and Shizuoka, Honshu, recognized them as a new species, and gave detailed description of adults, pupa and larva. Morphological characteristics of the three stages were also given in the previous paper by Sasa (1978). In the present survey, a total of 55 males and 55 females were recovered from samples collected at Station 6, but not from other sites where the water was less polluted.

SUMMARY

A survey of chironomid midges (Diptera, Chironomidae) breeding in the Minami-asakawa River, a tributary of the Tama River running through Tokyo Prefecture, was conducted as part of the special research project on "Eutrophication of Land Water" being carried out by members of the National Institute for Environmental Studies. Bottom samples (sand, stone, algae, etc.) were collected on 17 August 1979 from the riverbed of 6 sampling stations selected at intervals of about 2 km. Station No. 1, the uppermost, was representative of an unpolluted mountain stream on the slope of Mount Takao, while Station No. 6 was situated in downtown of Hachioji City, where the river water was largely composed of untreated sewage water discharged from houses and small industrial plants. The degree of pollution as indicated by various water quality indices was found to increase gradually according to the number of station from No. 1 to No. 6. The chironomid larvae contained in the bottom samples were reared in the laboratory by keeping in plastic containers to recover adult midges and pupal or larval exuviae. Identification was made by adult males as a rule.

As the result, a total of 20 species belonging to the subfamily Chironominae were identified and are described in the present paper, among which 4 species (*Tanytarsus oyamai*, *Polypedilum ureshinoense*, *Chironomus kiiensis*, *Chironomus yoshimatsui*) were the same as those collected elsewhere and described in the previous papers by Sasa (1978, 1979), two (*Rheotanytarsus kyotoensis* and *Polypedilum unifascium*) have already been described as adults by Tokunaga (1936, 1938), one (*Microtendipes britteni*) was tentatively identified as the same as the European population, while the remaining 13 species are newly reported. It is extremely interesting that the chironomids found in the river in Japan largely represented species indigenous to Japan. Furthermore, it was noted that the distribution of each chironomid species among the sampling stations correlated highly with the degree of eutrophication of the river water, thus suggesting that chironomids would be useful and sensitive indicators of the degree of pollution of rivers with sewage discharge.

ANNEX

Key to Genera and Species of Chironominae of the Minamiasakawa River

A. Key for adult males

- 1-a Wing membrane without macrotrichia. Squama fringed with long hairs. Cross vein r-m oblique I. CHIRONOMINI
- b Wing membrane with macrotrichiae. Squama bare. Cross vein r-m running parallel to the wing axis II. TANITARSINI

I. CHIRONOMINI

- 1-a Both combs of middle and hind tibiae with a spur. Ventral appendage without a long terminal hair. Dorsal appendage highly chitinized and bare except for the basal portion *Chironomus* 2
- b One comb of middle and hind tibiae with a spur, the other without spur (Fig. 41-F). Ventral appendage with a long terminal hair (exception: *Microtendipes*; (Fig. 42-H). Dorsal appendage with one or more long hairs arising from distal half (exception: *P. asakawaense*) 3
- 2-a Wing with clouds. Dorsal appendage with a large, setigerous base and a horn-like slender distal process *Ch. ktiensis*
- b Wing without clouds. Dorsal appendage with a low base, and a sickle-like, distally expanded apical process *Ch. yoshimatsui*
- 3-a Abdominal tergite VIII roughly rectangular (Fig. 34-E). Dorsomedian setae of scutum absent (Fig. 34-C). Ventral appendage of male hypopygium without a long terminal hair (Fig. 34-H) *Microtendipes brittani*
- b Abdominal tergite VIII basally narrowed and roughly triangular (Fig. 37-A). Dorsomedian setae of scutum present. Ventral appendage with a long apical hair (Fig. 37-E) *Polypedilum* 4
- 4-a Dorsal appendage pad-like, covered with numerous microtrichiae and with a long hair (Fig. 39-E). Anal tergite with a pair of tubercles on the posterior margin flanking anal point (subgenus *Tripodura* Fig. 39-C). Wing with two dark bands (Fig. 38-A) *P. unifascium*
- b Dorsal appendage hook-like, distal half highly chitinized and devoid of microtrichiae. Anal tergite without tubercles. (subgenus *Polypedilum*). Wing without dark bands 5
- 5-a Dorsal appendage with a hump-like posterior lobe carrying many microtrichiae and 2 or 3 long hairs, and a horn-like chitinized and bare apical process (Figs. 47-G, H) *P. ureshinoense*
- b Dorsal appendage without posterior lobe, composed of a bare, simple horn-like process (Fig. 45-C) 6
- 6-a Dorsal appendage rectangularly curved inwards, and without a long hair (Fig. 42-G). Thorax mostly dark brown, legs yellow, antennal shaft and abdomen black. Wing unmarked. Antennal flagellum 12 segmented. AR 1.9. fBR 1.0 *P. asakawaense*
- b Dorsal appendage with rounded inner margin and with a long hair. Antennal

- flagellum 13 segmented. AR 1.6 or less. fBR larger than 3.0 7
- 7-a Scutal stripes, postnotum and abdomen black, legs yellow. Wing with faint clouds (Fig. 44-A). Wing length 2.3 mm. AR 1.6 *P. tamagoryoense*
- b Body almost uniformly pale yellow. Wing unmarked (Fig. 36-A). Wing length 1.6 mm. AR 1.2 *P. takaoense*

II. TANYTARSINI

- 1-a Terminal comb scales of middle and hind tibiae contiguous and without spurs (Figs. 1-G, H). Appendage 1 with several dorsal setae and one long medially directed seta (Figs. 2-F, G). Appendage 2-a with spoon-shaped subterminal setae (Fig. 2-D) *Micropectra*
- b Terminal comb scales of middle and hind tibiae separated, and both or one has a long spur (Figs. 4-G, 20-F, G, H) 2
- 2-a Anal point without clusters of spines (Fig. 5-C) 3
- b Anal point with clusters of spines *Tanytarsus* (in part) 8
- 3-a Anal point without lateral ridges, and with numerous microtrichiae on the dorsal surface (Fig. 27-C). Appendage 1-a long and knife-like (Fig. 27-G) *Tanytarsus tamanonus*
- b Anal point with lateral ridges but bare. Appendage 1-a absent excepting *kyotoensis* *Rheotanytarsus* 4
- 4-a Appendage 2-a with extremely long subterminal hairs, reaching near apex of gonocoxite (Fig. 5-E) *Rh. tamasecundus*
- b Appendage 2-a with shorter hairs 5
- 5-a Lateral ridges of anal point united at the base of anal point forming a circle (Figs. 14-B, C) *Rh. tamaquintus*
- b Lateral ridges of anal point are open at the base of anal point 6
- 6-a Appendage 2-a distally bilobate, like a boxing glove (Figs. 17-F, G) *Rh. kyotoensis*
- b Appendage 2-a not distally bilobate 7
- 7-a Appendage 2-a not twisted and with a large, wide distal lamella (Figs. 11-C, D) *Rh. tamaquartus*
- b Appendage 2-a twisted and s-shaped, distal lamellae narrow (Figs. 8-G, H) *Rh. tamatertius*
- 8-a One of the terminal comb scales of middle and hind tibiae without spur (Figs. 20-F, G, H). Appendage 1-a absent (Fig. 21-D) *T. tamaseptimus*
- b Both comb scales with a long spur. Appendage 1-a present 9
- 9-a Appendage 2-a absent (Fig. 24-D). Appendage 1-a large and twisted (Figs. 24-F, G) *T. tamaoctavus*
- b Appendage 2-a present. 10
- 10-a Appendage 1 egg-shaped (Figs. 31-G, H). Anal point triangular (Fig. 31-E) *T. tamaundecimus*
- b Appendage 1 distally narrowed like a beak. Anal point parallel-sided 11
- 11-a Anal point with 10 spine clusters (Fig. 29-D). Appendage 1-a composed of a long spatulated dorsal process and a hook-like ventral process (Figs. 31-G, H) *T. tamadecimus*

- b Anal point with 4-5 spine clusters. Appendage 1-a simple, short and not extending beyond margin of appendage 1 *T. oyamai*

B. Key for pupae

- 1-a Thoracic respiratory organs divided into at least 4 branches . . I. CHIRONOMINI
- b Thoracic respiratory organs not branched, a simple tube . . . II. TANYTARSINI

I. CHIRONOMINI

- 1-a Thoracic respiratory organs divided into numerous fine filaments. Anal fin fringed with more than 60 filamentous hairs. *Chironomus*
- b Thoracic respiratory organs divided into 6-8 tubes. Anal fin fringed with less than 45 filamentous hairs 2
- 2-a Abdominal segments V to VIII with 3, 4, 4 and 5 pairs of long, filamentous lateral hairs. Thoracic respiratory organs divided into 7 or 8 tubes (Figs. 35-A, B) *Microtendipes britteni*
- b Abdominal segments V to VIII with 3, 3, 4 and 4 pairs of long, filamentous lateral hairs. *Polypedilum* 3
- 3-a Anal fins with a pair of long, simple hairs on the dorsal side near bases of marginal filaments. Sternite III with a reversed U-shaped band of numerous long (22-28 microns) spines (Fig. 40, III-v). Thoracic respiratory organ with 8 branches (Fig. 40-A) *P. unifascium*
- b Anal fins without hairs on the dorsal side. Sternite III without a band of long spines. Thoracic respiratory organs with 6 branches 4
- 4-a Caudolateral scales of abdominal segment VIII with 1-3 conspicuous accessory spines (Fig. 48-G). Distribution of spines on abdominal segments as in Fig. 48-B *P. ureshinoense*
- b Caudolateral scales of abdominal segment VIII a simple spine, without accessory spines (Fig. 43-D) 5
- 5-a Anal fin fringed with 38-41 filamentous hairs on each side. Spinose areas on tergites II-VI large and contiguous (Fig. 43-B) *P. asakawaense*
- b Anal fin fringed with 18-19 filamentous hairs on each side. Spinose areas on tergites II-VI separated into the oral and the caudal groups *P. takaoense*

II. TANYTARSINI

- 1-a Thoracic respiratory organs with numerous long, needle-like hairs (Fig. 3-A). Abdominal tergite III with a pair of crescent-shaped spinose areas in the caudal half, bearing long spines (Fig. 3-B) *Micropsectra*
- b Thoracic respiratory organs bare, or with minute spines 2
- 2-a Caudolateral scales of segment VIII with a simple terminal spine. Abdominal tergites II to IV or II to V with a pair of well defined, pigmented spine patches in the oral one third. Anal segment with a pair of simple hairs on the dorsal side. *Rheotanytarsus* 3
- b Caudolateral scales of segment VIII with several terminal spines, or if terminal

- spine is simple, abdominal tergites without well-defined, pigmented spine patches *Tanytarsus* 7
- 3-a Tergite V without well-defined spine patches. Tergite II with a pair of spinose areas in the caudal half too, which consists of 4 or 5 large and blunt spines. Segment VIII with 5 pairs of filamentous lateral hairs (Fig. 6-B) *Rh. tamasecundus*
- b Tergite V with a pair of well-defined spine patches. Tergite II without such spine groups in the caudal half. Segment VIII with 4 pairs of filamentous lateral hairs 4
- 4-a Tergites III and IV without spinulose areas (Fig. 9-B) *Rh. tamateritius*
- b Tergites III and IV with spinulose areas continuous to the pigmented spine patches 5
- 5-a Spinulose areas on tergites III and IV are on the lateral sides of the spine patches. Abdominal sheath of pupal exuviae darker than all other *Rheotanytarsus* species described here (Fig. 15-B) *Rh. tamaquintus*
- b Spinulose areas on tergites III and IV are on the caudal side of the spine patches 6
- 6-a Tergite VI with pigmented spine patches. Tergite VII without spinulose areas (Fig. 12-B) *Rh. tamaquartus*
- b Tergite VI with a few spines but not on well defined patches. Tergite VII with large proximal spinulose areas (Fig. 18-B) *Rh. kyotoensis*
- 7-a Caudolateral scales of segment VIII with a single terminal spine. Spines on tergites II to VI all narrow and needle-like, with a small subterminal hook (Fig. 22-B) *T. tamaseptimus*
- b Caudolateral scales of segment VIII with several terminal spines. Spines on tergites II to VI either much longer, or shorter and stouter 8
- 8-a Tergite III and IV with a pair of longitudinal rows of very long spines (Fig. 22-B) *T. tamaundecimus*
- b Tergites II to VI with a pair of pigmented patches of short spines (Fig. 25-B) *T. tamaoctavus*

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Table 1.
Standard measurements of wing venation

Species Code No.	Species name	Fig.	Sex	Wing length (mm)	Percentage to wing length													
					ww	sc	R1	R2+3	R4+5	Cs	M	Cu1	Cu2	An	r-m	fCu	m-Cu	
1.	<i>Micropsectra tamaprima</i>	1-C	M	1.67	26	57	76	-	96	96	99	89	66	43	47	47	-	
		1-D	F	1.74	30	55	74	-	97	97	99	85	63	44	45	45	-	
2.	<i>Rheotanytarsus tamasecundus</i>	4-A	M	1.10	28	53	70	-	94	94	100	88	69	47	41	53	-	
		4-A	F	1.24	32	50	67	-	93	93	100	88	68	47	36	49	-	
3.	<i>Rheotanytarsus tamatertius</i>	7-G	M	1.21	27	54	71	-	93	93	99	93	67	46	39	49	-	
4.	<i>Rheotanytarus tamaquartus</i>	10-A	M	1.40	28	50	70	-	93	93	99	88	68	48	40	50	-	
		10-A	F	1.48	30	51	67	-	92	92	99	88	67	49	40	51	-	
5.	<i>Rheotanytarsus tamaquintus</i>	13-A	M	1.16	28	55	73	-	94	94	98	89	72	48	41	55	-	
		13-A	F	1.33	32	49	66	-	96	96	99	85	67	42	41	50	-	
6.	<i>Rheotanytarsus kyotoensis</i>	16-A	M	1.43	26	54	74	-	96	96	99	87	69	46	38	49	-	
		16-A	F	1.53	28	54	74	-	95	95	98	86	69	46	36	49	-	
7.	<i>Tanytarsus tamaseptimus</i>	20-D	M	0.92	29	55	71	78	90	90	99	88	69	49	45	59	-	
8.	<i>Tanytarsus tamaoctavus</i>	23-A	M	1.28	28	59	71	75	93	93	99	90	69	49	46	54	-	
		23-A	F	1.25	30	56	67	78	95	95	98	88	67	47	41	50	-	
9.	<i>Tanytarsus tamanonus</i>	26-B	M	1.00	30	57	67	-	91	91	99	89	70	44	46	57	-	
10.	<i>Tanytarsus tamadecimus</i>	28-A	M	2.48	25	64	75	82	96	96	99	92	72	53	46	53	-	

Table 1. (continued)

Species Code No.	Species name	Fig.	Sex	Wing length (mm)	Percentage to wing length												
					ww	sc	R1	R2+3	R4+5	Cs	M	Cu1	Cu2	An	r-m	fCu	m-Cu
11.	<i>Tanytarsus</i>	30-A	M	1.44	26	58	75	86	94	94	99	84	68	46	43	49	-
	<i>tamaundecimus</i>	30-A	F	1.46	29	57	74	86	94	94	99	87	68	47	43	49	-
13.	<i>Microtendipes</i>	33-A	M	2.69	24	59	81	86	99	99	98	89	69	60	50	54	-
	<i>britteni</i>	33-A	F	2.69	29	57	81	84	99	99	98	89	67	59	49	53	-
14.	<i>Polypedilum</i>	36-A	M	1.63	27	57	79	83	99	99	97	90	69	54	47	54	-
	<i>takaoense</i>	36-A	F	1.97	28	59	76	82	99	99	97	87	68	54	46	54	-
15.	<i>Polypedilum</i>	38-A	M	2.00	25	63	80	84	99	99	97	89	68	55	51	57	-
	<i>unifascium</i>	38-A	F	1.87	30	64	79	81	99	99	97	87	67	54	49	56	-
16.	<i>Polypedilum</i>	41-A	M	2.12	26	60	80	82	99	99	97	87	69	57	49	54	-
	<i>asakawaense</i>	41-A	F	2.20	27	61	79	81	99	99	98	87	69	58	46	52	-
17.	<i>Polypedilum</i>	44-A	M	2.01	25	64	81	87	99	99	97	88	72	55	55	58	-
	<i>tamagoryoense</i>	44-A	F	2.16	29	64	78	83	99	99	97	88	67	58	47	53	-
18.	<i>Polypedilum</i>	46-A	M	2.00	25	63	80	84	99	99	97	89	68	55	51	57	-
	<i>ureshinoense</i>	46-A	F	2.40	30	64	79	81	99	99	97	87	67	54	49	56	-

Table 2.
Comparison of relative length of leg segments and hairs on tarsus I

Species Code	Species name	Sex	Leg No.	Length in unit of 0.01 mm							Ratio	
				f e	ti	t-1	t-2	t-3	t-4	t-5	LR	BR
1	<i>Micropsectra tamaprima</i>	M	I	94	55	116	54	41	31	16	2.11	3.7
			II	81	69	41	23	17	12	10	0.59	5.4
			III	100	86	63	38	29	16	10	0.74	7.6
		F	I	93	56	123	60	42	32	16	2.19	3.1
			II	87	68	40	23	17	11	8	0.59	4.1
			III	97	84	60	35	28	16	10	0.72	4.2
2	<i>Rheotanytarsus tamasecundus</i>	M	I	50	28	61	32	24	19	10	2.17	3.2
			II	51	37	20	12	9	6	5	0.55	4.6
			III	54	43	32	19	17	11	7	0.75	3.0
		F	I	58	32	68	34	26	19	11	2.12	2.0
			II	60	43	24	12	9	7	6	0.57	3.0
			III	65	50	34	19	17	11	7	0.69	4.4
3	<i>Rheotanytarsus tamatertius</i>	M	I	55	35	66	31	25	21	11	2.13	2.1
			II	56	42	26	13	11	7	6	0.61	5.7
			III	62	51	36	20	18	12	6	0.70	4.8
4	<i>Rheotanytarsus tamaquartus</i>	M	I	68	37	81	41	31	25	11	2.18	3.9
			II	67	50	30	15	11	8	5	0.60	7.0
			III	70	60	42	24	20	13	8	0.70	5.9
		F	I	75	37	91	47	34	28	12	2.47	1.6
			II	67	52	32	15	11	8	7	0.62	3.6
			III	74	61	41	25	19	13	8	0.67	3.4
5	<i>Rheotanytarsus tamaquintus</i>	M	I	36	27	56	29	22	18	9	2.04	2.0
			II	49	34	19	9	8	6	4	0.57	3.6
			III	54	41	29	17	15	14	7	0.71	2.1
		F	I	55	30	60	34	24	19	10	2.00	2.0
			II	54	41	23	10	8	6	5	0.57	3.1
			III	58	46	31	17	14	11	8	0.67	4.9
6	<i>Rheotanytarsus kyotoensis</i>	M	I	77	41	87	47	36	28	12	2.12	2.6
			II	74	56	35	19	14	10	7	0.63	5.8
			III	78	69	47	29	25	17	9	0.68	2.4
		F	I	76	43	87	47	35	27	12	2.02	1.9
			II	73	58	32	17	13	8	7	0.55	4.6
			III	78	70	45	27	22	14	9	0.64	1.6
7	<i>Tanytarsus tamaseptimus</i>	M	I	38	22	40	22	18	13	7	1.82	3.8
			II	42	31	20	9	7	5	4	0.63	6.3
			III	44	33	23	17	12	9	5	0.70	4.2

Table 2. (continued)

Species Code	Species name	Sex	Leg No.	Length in unit of 0.01 mm							Ratio	
				fe	II	t-1	t-2	t-3	t-4	t-5	LR	BR
8	<i>Tanytarsus tamaoctavus</i>	M	I	60	29	73	36	28	23	16	2.52	2.0
			II	55	43	25	12	9	6	5	0.58	5.4
			III	58	54	40	23	21	13	8	0.74	3.3
		F	I	57	29	74	35	28	24	16	2.55	3.3
			II	55	42	23	12	8	6	5	0.55	3.6
			III	58	52	36	20	19	12	8	0.69	3.0
9	<i>Tanytarsus tamanonus</i>	M	I	35	21	38	19	14	11	7	1.77	2.6
			II	40	30	15	8	6	5	4	0.52	3.2
			III	41	37	21	14	12	10	7	0.68	2.0
10	<i>Tanytarsus tamadecimus</i>	M	I	96	60	109	55	44	36	16	1.82	3.0
			II	98	74	39	24	18	13	10	0.53	4.2
			III	112	103	72	43	38	25	14	0.70	3.2
11	<i>Tanytarsus tamaundecimus</i>	M	I	82	35	115	47	43	37	15	3.28	3.3
			II	72	55	34	16	12	8	7	0.62	9.4
			III	80	69	55	31	27	19	10	0.80	5.3
		F	I	77	34	111	45	41	36	15	3.26	3.0
			II	71	53	32	14	10	6	5	0.60	4.4
			III	72	65	46	26	24	13	9	0.71	3.6
13	<i>Microtendipes britteni</i>	M	I	132	122	161	78	71	61	27	1.32	1.0
			II	134	124	81	44	32	21	10	0.65	3.2
			III	144	132	100	59	41	25	12	0.76	1.0
		F	I	142	132	185	90	83	73	32	1.41	1.5
			II	151	141	83	49	34	22	12	0.59	2.3
			III	163	151	110	63	46	28	13	0.73	3.5
14	<i>Polypedilum takaoense</i>	M	I	67	47	83	58	40	31	14	1.77	3.1
			II	75	63	38	22	16	11	7	0.60	4.5
			III	77	71	52	30	22	16	8	0.73	2.7
		F	I	109	66	121	80	53	44	18	1.83	2.0
			II	105	90	50	29	21	14	8	0.56	3.0
			III	109	99	74	41	33	21	10	0.75	1.9
15	<i>Polypedilum unifascium</i>	M	I	85	54	96	71	50	37	17	1.77	2.7
			II	85	76	42	28	18	14	7	0.55	5.0
			III	97	88	60	37	28	19	11	0.68	4.8
		F	I	90	58	99	70	50	38	17	1.70	2.0
			II	91	79	43	27	20	13	9	0.54	3.1
			III	108	88	64	47	30	19	10	0.73	3.4
16	<i>Polypedilum asakawaense</i>	M	I	94	70	120	75	55	47	21	1.72	1.0
			II	102	87	51	30	21	14	8	0.60	6.9
			III	114	96	71	44	32	20	20	0.74	8.7
		F	I	101	75	136	78	59	51	22	1.82	2.8
			II	102	90	51	28	20	13	8	0.56	2.9
			III	107	100	76	44	31	20	10	0.76	2.1

Table 2. (continued)

Species Code	Species name	Sex	Leg No.	Length in unit of 0.01 mm							Ratio	
				fe	ti	t-1	t-2	t-3	t-4	t-5	LR	BR
17	<i>Polypedilum tamagoryoense</i>	M	I	87	73	114	71	57	47	22	1.56	3.5
			II	98	89	50	33	24	16	10	0.55	4.6
			III	109	105	78	44	32	20	12	0.74	6.1
18	<i>Polypedilum ureshinoense</i>	M	I	85	54	96	71	50	37	17	1.77	2.7
			II	85	76	42	28	18	14	7	0.55	5.0
			III	97	88	60	37	28	19	11	0.68	4.8
		F	I	90	58	99	70	50	38	17	1.70	2.0
			II	91	79	43	27	20	13	9	0.54	3.1
			III	108	88	64	47	20	19	10	0.73	3.4

Table 3.
Comparison of pupal chaetotaxy

Species	TRO	II	III	IV	V	VI	VII	VIII	CL	IX
1. <i>Micropsectra tamaprima</i>	1	sss	sss	LsL	LLL	LLLL	LLLL	LLLLL	3	L + 30L
2. <i>Rheotanytarsus tamasecundus</i>	1	sss	sss	ssL	LLL	LLLL	LLLL	LLLLL	1	s + 25 - 28L
3. <i>Rheotanytarsus tamatertius</i>	1	sss	sss	ssL	LLL	LLLL	LLLL	LLLL	1	s + 14 - 17L
4. <i>Rheotanytarsus tamaquartus</i>	1	sss	sss	ssL	LLL	LLLL	LLLL	LLLL	1	s + 17 - 21L
5. <i>Rheotanytarsus tamaquintus</i>	1	sss	sss	ssL	LLL	LLLL	LLLL	LLLL	1	s + 17 - 20L
6. <i>Rheotanytarsus kyotoensis</i>	1	sss	sss	ssL	LLL	LLLL	LLLL	LLLL	1	s + 15 - 26L
7. <i>Tanytarsus tamaseptimus</i>	1	sss	sLs	sLs	LLL	LLLL	LLLL	LLL	1	o + 16L
8. <i>Tanytarsus tamaoctavus</i>	1	sss	sss	sss	sss	sLs	sLLL	LLLLL	5	LL + 30 - 34L
11. <i>Tanytarsus tamaundecimus</i>	1	sss	sss	sss	sss	sss	ssLL	LLLLL	6	LL + 38 - 42L
13. <i>Microtendipes britteni</i>	6	sss	sss	sss	LLL	LLLL	LLLL	LLLLL	3-4	30 - 42L
15. <i>Polypedilum unifascium</i>	8	sss	sss	sss	LLL	LLL	LLLL	LLLL	1-4	s + 18 - 23L
16. <i>Polypedilum asakawaense</i>	6	sss	sss	sss	LLL	LLL	LLLL	LLLL	1	38 - 41L
18. <i>Polypedilum ureshinoense</i>	6	sss	sss	sss	LLL	LLL	LLLL	LLLL	2-3	29 - 41L
19. <i>Chironomus kiiensis</i>	n	sss	sss	sss	LLLL	LLLL	LLLL	LLLLL	1-2	63 - 90L
20. <i>Chironomus yoshimatsui</i>	n	sss	sss	sss	LLLL	LLLL	LLLL	LLLLL	1-3	72 - 100L

TRO : number of branches of thoracic respiratory organs; n=numerous.

II to IX : number and character of lateral hairs on abdominal segments II to IX; s: short and simple hair; L: long filamentous hair.

CL : number of terminal spines of caudolateral scales of segment VIII.

EXPLANATION OF FIGURES

(1) *Micropsectra tamaprimus*, sp. nov.

Plate 1. Adult. A. lateral aspect of thorax, male. B. do, female. C. wing, male. D. wing, female. E. hind tarsus V, male. F. tip of front tibia, male. G. tip of middle tibia, male. H. tip of hind tibia, male. I. middle tarsus I, female. J. cercus, female. K. spermatheca. L. tip of front tibia, female. M. tip of middle tibia, female. N. tip of hind tibia, female.

Plate 2. Male hypopygium. A. dorsal aspect. B. ventral aspect. C. anal point. D. appendages 2 and 2-a, dorsal. E. do, ventral. F. appendage 1, dorsal. G. do, ventral.

Plate 3. Pupa. A. thoracic respiratory organ. B. abdominal tergites I - VII. C. spines and spinules on tergites (II-c, II-d, III-c, IV-a, V-a). D. caudolateral scale of segment VIII. E. segment VIII and IX, dorsal, right half.

(2) *Rheotanytarsus tamasecundus*, sp. nov.

Plate 4. Adult. A. wing. B. thorax, lateral. C. female palp. D. female antenna. E. male antenna (hairs removed). F. tip of front tibia, male. G. tip of hind tibia, male. H. spermatheca. I. female cercus.

Plate 5. Male hypopygium. A. dorsal view. B. ventral view. C. anal point. D. appendage 1. E. appendages 2 and 2-a.

Plate 6. Pupa. A. thoracic respiratory organ. B. abdominal tergites. C. spines and spinules on tergites (II-a, II-c, II-d, III-a, IV-a). D. caudolateral scale of segment VIII. E. anal segment, fringe hairs removed.

(3) *Rheotanytarsus tamatertius*, sp. nov.

Plate 7. Male. A. antenna (hairs removed). B. head, frontal view. C. tip of front tibia. D. tip of middle tibia. E. tip of hind tibia. F. thorax, lateral. G. wing.

Plate 8. Male hypopygium. A. dorsal view. B. ventral view. C. gonostylus. D. appendage 1, dorsal. E. appendage 1, ventral. F. anal point. G. appendages 2 and 2-a, dorsal. H. appendage 2-a, ventral.

Plate 9. Pupa. A. thoracic respiratory organs. B. abdominal tergites. C. spines on tergites II - VI. D. caudolateral scales of segment VIII. E. anal segment.

(4) *Rheotanytarsus tamaquartus*, sp. nov.

Plate 10. Adult. A. wing. B. female, antenna. C. female palp. D. thorax, dorsal view, male. E. tip of front tibia, female. F. tip of hind tibia, female. G. spermathecae. H. cercus.

Plate 11. Male hypopygium. A. dorsal view. B. anal point. C. appendages 2 and 2-a, dorsal view. D. do, ventral view. E. appendage 1. F. gonostylus. G. tip of front tibia, male. H. tip of hind tibia, male.

Plate 12. Pupa. A. thoracic respiratory organ. B. abdominal tergites. C. spines and spinules on tergites. D. tergite VIII and anal segment.

(5) *Rheotanytarsus tamaquintus*, sp. nov.

Plate 13. Adult. A. wing. B. female palp. C. female antenna. D. male antenna. E. spermathecae. F. female cercus. G. tip of front tibia, female. H. tip of middle tibia, female. I. tip of hind tibia, female.

Plate 14. Male. A. hypopygium, dorsal view. B. anal point, lateral view. C. anal point, dorsal view. D. gonostylus. E. appendage 1, dorsal view. F. appendages 2 and 2-a, dorsal view. G. do, ventral view. H. tip of front tibia. I. tip of hind tibia.

Plate 15. Pupa. A. thoracic respiratory organ. B. abdominal tergites. C. spine patches and spine groups on tergites. D. 8th and anal segments.

(6) *Rheotanytarsus kyotoensis* (Tokunaga, 1938)

Plate 16. Adult. A. wing. B. female antenna. C. female palp. D. thorax, dorsal view, female. E. do, male. F. head, frontal view, female. G. spermathecae. H. cercus. I. tip of front tibia, female. J. tip of hind tibia, female.

Plate 17. Male. A. tip of front tibia. B. tip of hind tibia. C. hypopygium, dorsal view. D. appendage 1, dorsal view. E. anal point. F. appendages 2 and 2-a, dorsal view. G. do, ventral view.

Plate 18. Pupa. A. thoracic respiratory organ. B. abdominal tergites. C. spines and spinules on tergites and sternites (II-a, II-c, II-d, III-a, IV-a, IV-v, V-a, V-v, VI-b, VII-a). D. tip of caudolateral scales of segment VIII. E. anal segment, dorsal.

Plate 19. Larva. A. labial plate and paralabial plates. B. labrum, epipharynx and premandible. C. antenna. D. mandible. E. claws of anterior pseudopod. F. claws of posterior pseudopods. G. base of anal hair tuft. H. anal segments.

(7) *Tanytarsus tamaseptimus*, sp. nov.

Plate 20. Male. A. antennal shaft. B. head, frontal view. C. frontal tubercles. D. wing. E. tip of front tibia. F. tip of middle tibia, lateral view. G. do, frontal view. H. tip of hind tibia. I. thorax, lateral view.

Plate 21. Male hypopygium. A. dorsal view. B. ventral view. C. anal point. D. appendage 1. E. appendages 2 and 2-a, dorsal view. F. gonostylus.

Plate 22. Pupa. A. thoracic respiratory organ. B. abdominal tergites. C. spines on tergites (II-b, II-d, III-b, IV-b, V-b). D. abdominal segments VIII and IX, dorsal.

(8) *Tanytarsus tamaoctavus*, sp. nov.

Plate 23. Adult. A. wing. B. female antenna. C. female palp. D. thorax, dorsal view, male. E. tip of front tibia, female. F. tip of middle tibia, female. G. female cercus. H. spermathecae.

Plate 24. Male hypopygium. A. dorsal view. B. ventral view. C. anal point. D. appendage 2, dorsal. E. gonostylus. F. appendage 1, dorsal. G. do, ventral.

Plate 25. Pupa. A. thoracic respiratory organs. B. abdominal tergites. C. spines and spinules on tergites (II-a, II-b, II-c, II-d, III-a, IV-a, V-a, VI-a). D. caudolateral scales of segment VIII. E. anal segment, dorsal.

(9) *Tanytarsus tamanonus*, sp. nov.

Plate 26. Male. A. antennal shaft. B. wing. C. head. D. tip of front tibia. E. tip of hind tibia.

Plate 27. Male hypopygium. A. dorsal view. B. ventral view. C. anal point. D. gonocoxite, dorsal view. E. gonocoxite, ventral view. F. appendages 1 and 1-a, dorsal view. G. do, ventral view. H. appendages 2 and 2-a, dorsal view.

(10) *Tanytarsus tamadecimus*, sp. nov.

Plate 28. Male. A. wing. B. head. C. frontal tubercles. D. tip of front tibia. E. tip of hind tibia.

Plate 29. Male hypopygium. A. ventral view. B. dorsal view. C. gonostylus, dorsal view. D. anal point. E. appendage 2, dorsal. F. appendages 1 and 1-a, dorsal view. G. do, ventral view.

(11) *Tanytarsus tamaundecimus*, sp. nov.

Plate 30. Adult. A. wing. B. thorax, lateral. C. frontal tubercles, male. D. do, female. E. tip of front tibia, female. F. front tarsus I, female. G. female palp. H. female antenna. I. spermathecae. J. cercus.

Plate 31. Male. A. hypopygium, dorsal view. B. gonostylus, dorsal view. C. tip of front tibia. D. tip of hind tibia. E. anal point. F. appendages 2 and 2-a, dorsal view. G. appendages 1 and 1-a, ventral view. H. do, dorsal view.

Plate 32. Pupa. A. thoracic respiratory organ. B. abdominal tergites. C. spine groups on tergites (II-c, II-d, III-a, IV-a, V-a, VI-a). D. caudolateral scales of segment VIII.

(13) *Microtendipes britteni* (Edwards, 1929)

Plate 33. Adult. A. wing. B. female palp. C. female antenna. D. thorax, dorsal view, female. E. tip of front tibia and base of tarsus I, female. F. tip of hind tibia, female. G. female cercus. H. spermathecae.

Plate 34. Male. A. tip of middle tibia. B. anal point. C. thorax, dorsal. D. tip of front tibia. E. abdominal tergites VIII, IX and hypopygium, dorsal. F. gonostylus. G. dorsal appendage.

Plate 35. Pupa. A. thoracic respiratory organs. B. abdominal segments, lateral view. C. spines and spinules on abdominal tergites (II-a, II-b, II-c, II-d, III-a, III-d, IV-d, VII-c, VIII-b). D. tip of caudolateral scales of segment VIII.

(14) *Polypedilum takaoense*, sp. nov.

Plate 36. Adult. A. wing. B. female antenna. C. tip of front tibia, male. D. tip of middle tibia, male. E. tip of front tibia, female. F. tip of hind tibia, female. G. spermatheca. H. female cercus.

Plate 37. Male. A. abdominal segments VIII, IX and hypopygium, dorsal view. B. anal point. C. appendage 1 (dorsal appendage). D. appendage 2 (ventral appendage). E. hypopygium, ventral view.

(15) *Polypedilum unifascium* (Tokunaga, 1938).

Plate 38. Adult. A. wing. B. female palp. C. female antenna. D. lateral aspect of thorax, female. E. tip of front tibia, female. F. tip of middle tibia, female. G. spermatheca. H. cercus.

Plate 39. Male. A. tergites VIII, IX and hypopygium, dorsal. B. hypopygium, ventral. C. anal point. D. ventral appendage. E. dorsal appendage. F. tip of front tibia, dorsal view. G. do, lateral view. H. tip of middle tibia.

Plate 40. Pupa. A. thoracic respiratory organs. B. abdominal segments, lateral view. C. spines and spinules on abdominal segments (I-v: spinules on sternite I. II-a: oral spinose area on tergite II. II-b: central spinose area, tergite II, oral part. II-c: central spinose area, tergite II, caudal part. II-d: caudal row of recurved spines. III-a: oral spinose area, tergite III. III-d: caudal row of recurved spines, tergite III. III-v: spinose area of sternite III. IV-c: central spinose area, caudal part, tergite IV. IV-v: central spinose area, sternite IV. IV-w: whirl-like spinose area in caudolateral corner of sternite IV. VI-a: oral spinose area on tergite VI. VIII-a: oral spinulose area on tergite VIII). D. caudolateral scales of segment VIII.

(16) *Polypedilum asakawaense*, sp. nov.

Plate 41. Adult. A. wing. B. female palp. C. female antenna. D. head, male, frontal view. E. tip of front tibia, female. F. tip of middle tibia, female. G. spermatheca. H. female cercus.

Plate 42. Adult. A. 8th tergite, male, dorsal. B. male hypopygium, dorsal. C. tip of front tibia, male. D. tip of middle tibia, male. E. gonostylus, ventral view. F. anal point. G. dorsal appendage. H. ventral appendage. I. middle tarsus V, female.

Plate 43. Pupa. A. thoracic respiratory organs. B. abdominal segments, lateral view. C. spines and spinules on abdominal segments (II-a, II-b, II-c, II-d, III-a, III-b, III-d, IV-w, VII-a, VII-v, VIII-v). D. caudolateral scales of segment VIII.

(17) *Polypedilum tamagoryoense*, sp. nov.

Plate 44. Adult. A. wing. B. lateral aspect of thorax, male. C. do, female. D. tip of front tibia, male. E. do, female. F. tip of middle tibia, female. G. spermathecae. H. female cercus.

Plate 45. Male hypopygium. A. abdominal tergites VIII, IX and hypopygium, dorsal

view. B. anal point. C. dorsal appendage. D. ventral appendage. E. gonostylus.

(18) *Polypedilum ureshinoense* (Sasa, 1979)

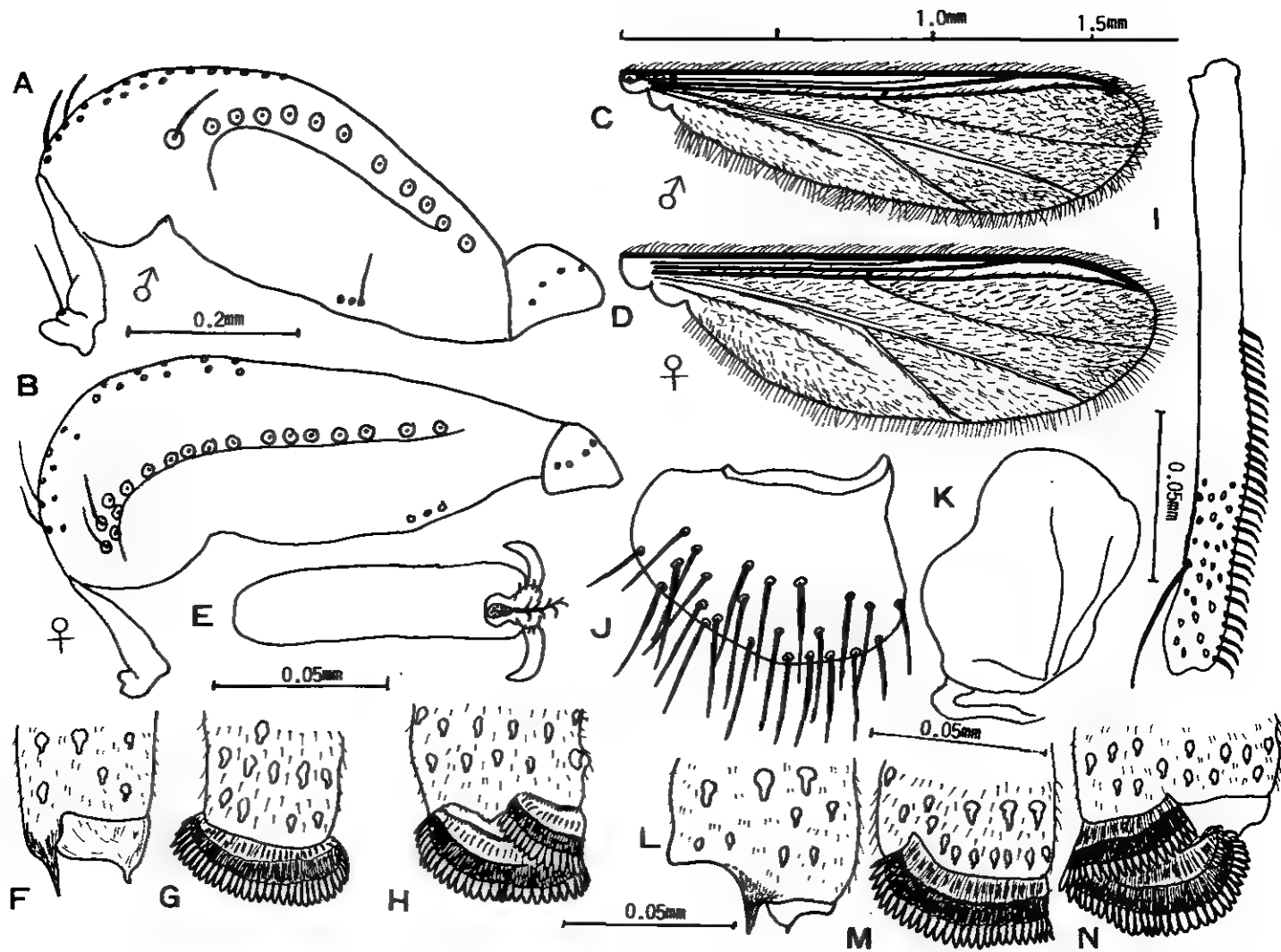
Plate 46. Adult. A. wing. B. female antenna. C. female palp. D. dorsal view of thorax, male. E. do, female. F. tip of front tibia, female. G. female cercus. H. spermathecae.

Plate 47. Male. A. tip of front tibia. B. tip of middle tibia. C. abdominal tergites VIII, IX and hypopygium, dorsal view. D. anal point. E. gonostylus, ventral view. F. ventral appendage. G. dorsal appendage, dorsal view. H. do, ventral view.

Plate 48. Pupa. A. thoracic respiratory organs. B. dorsal view of abdominal segments. C. spines and spinules on abdominal segments (II-a, II-b, II-c, II-d, III-a, III-b, III-c, III-d, IV-w, VII-a). D. caudolateral scales of segment VIII.

Plate 49. Larva. A. labial plate and paralabial plates. B. mandible. C. maxilla. D. labrum, premandible and epipharynx. E. antenna. F. claws on anterior pseudopod. G. base of anal hair tuft. H. claws on posterior pseudopod. I. anal segments.

Plate 1. *Micropsectra lamprinus*, sp. nov. Adult.



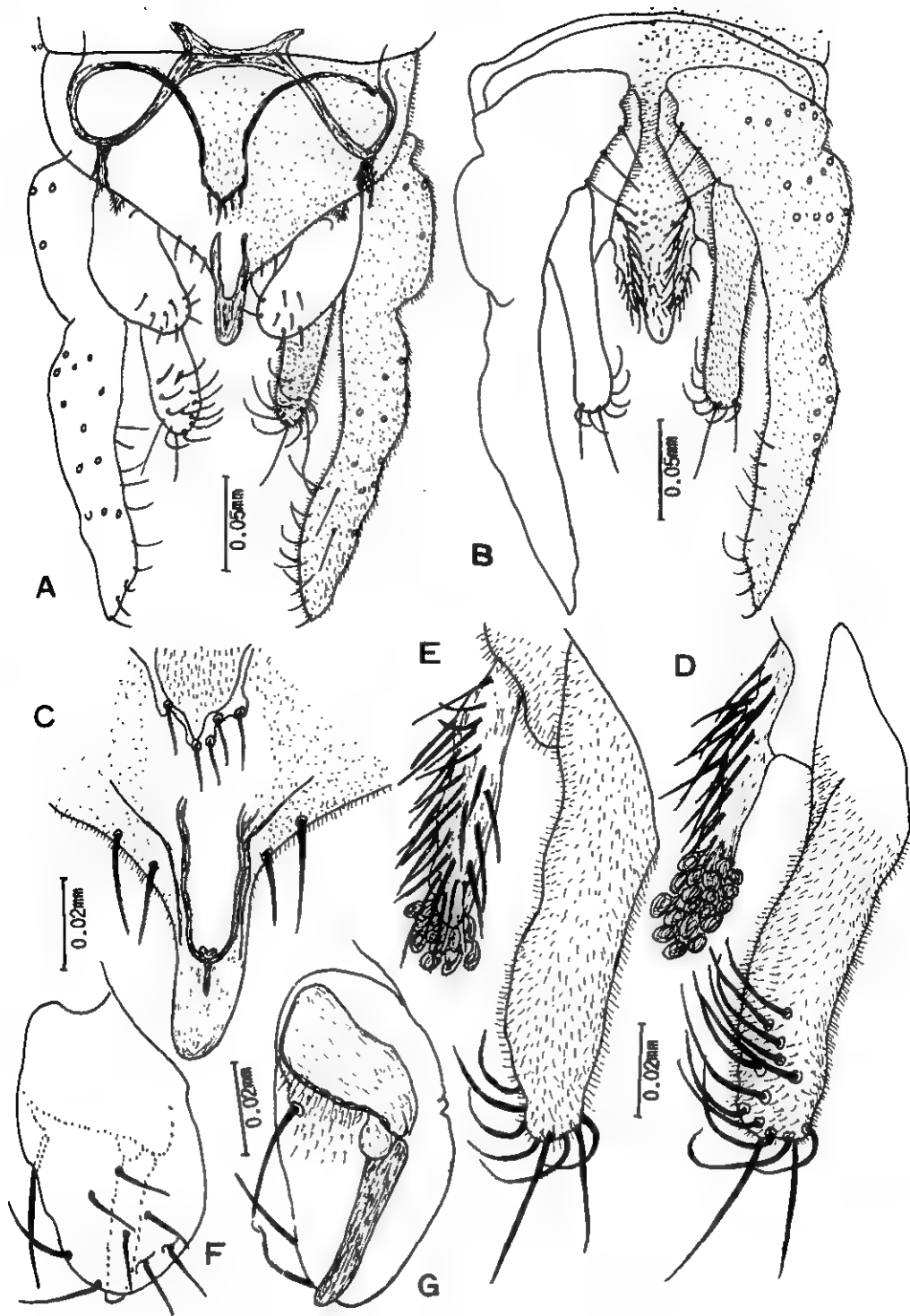


Plate 2. *Micropsectra tamaprimus*, sp. nov. Male hypopygium.

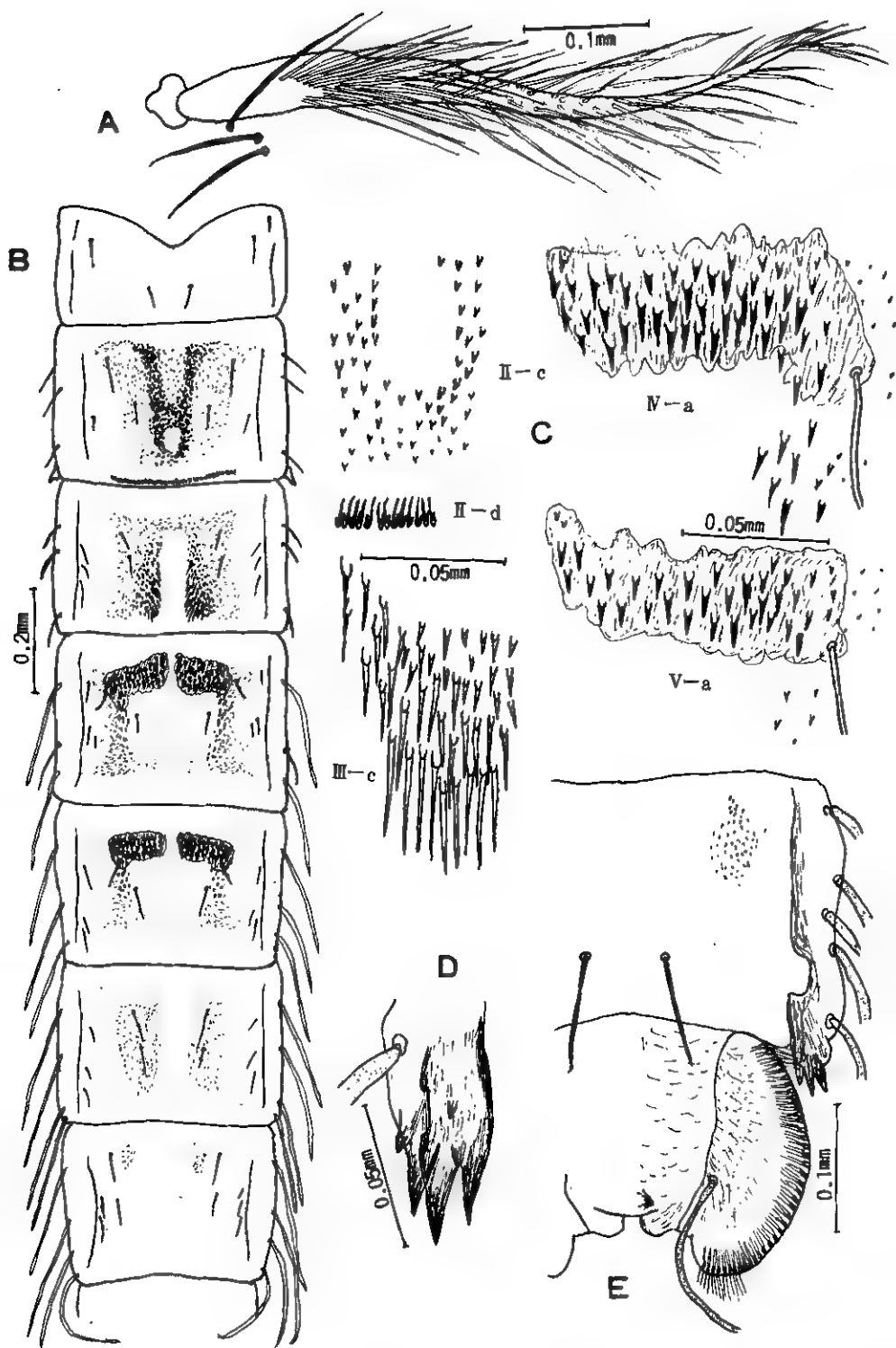


Plate 3. *Micropsectra tamaprimus*, sp. nov. Pupa.

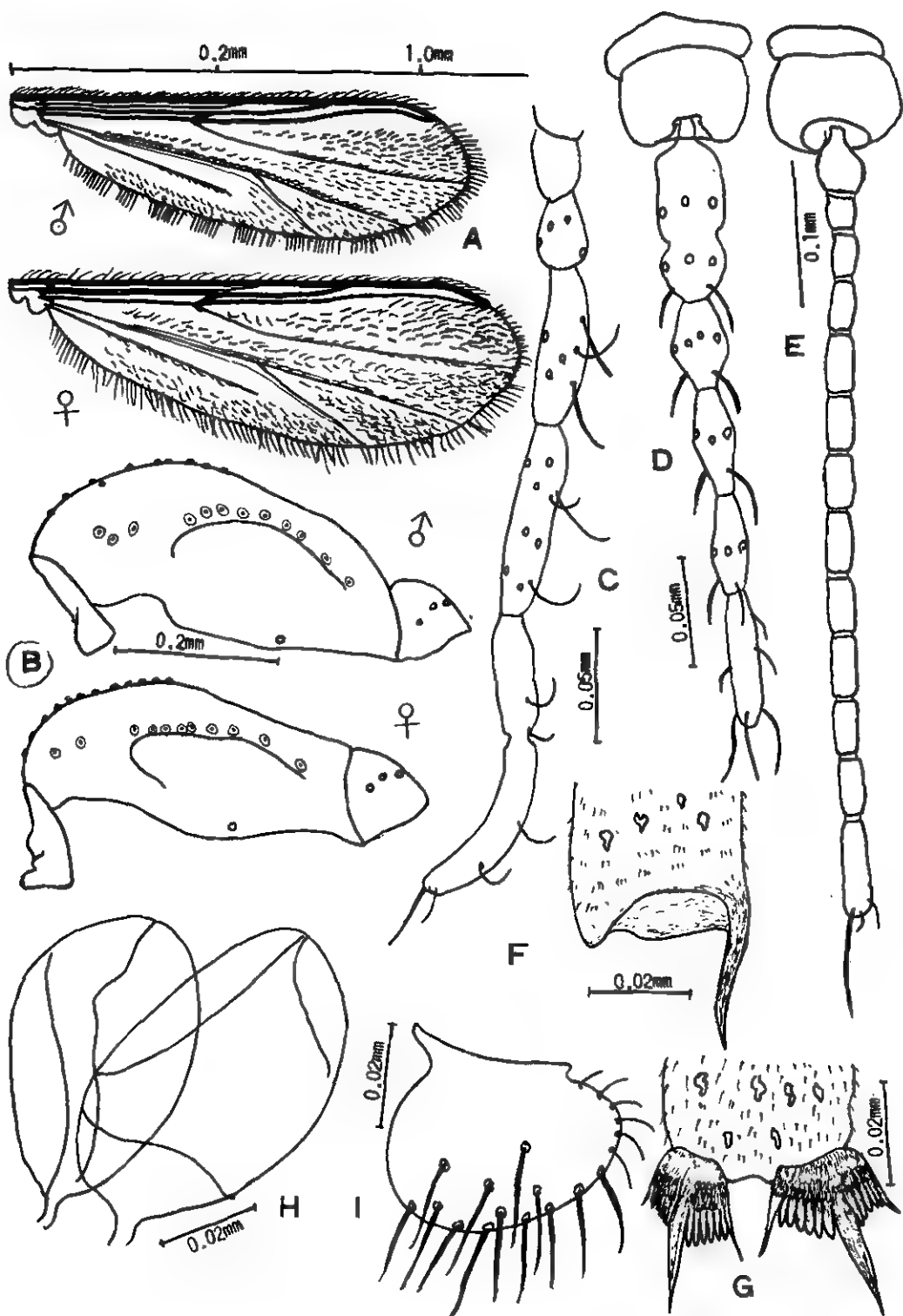


Plate 4. *Rheotanytarsus tamasecundus*, sp. nov. Adult.

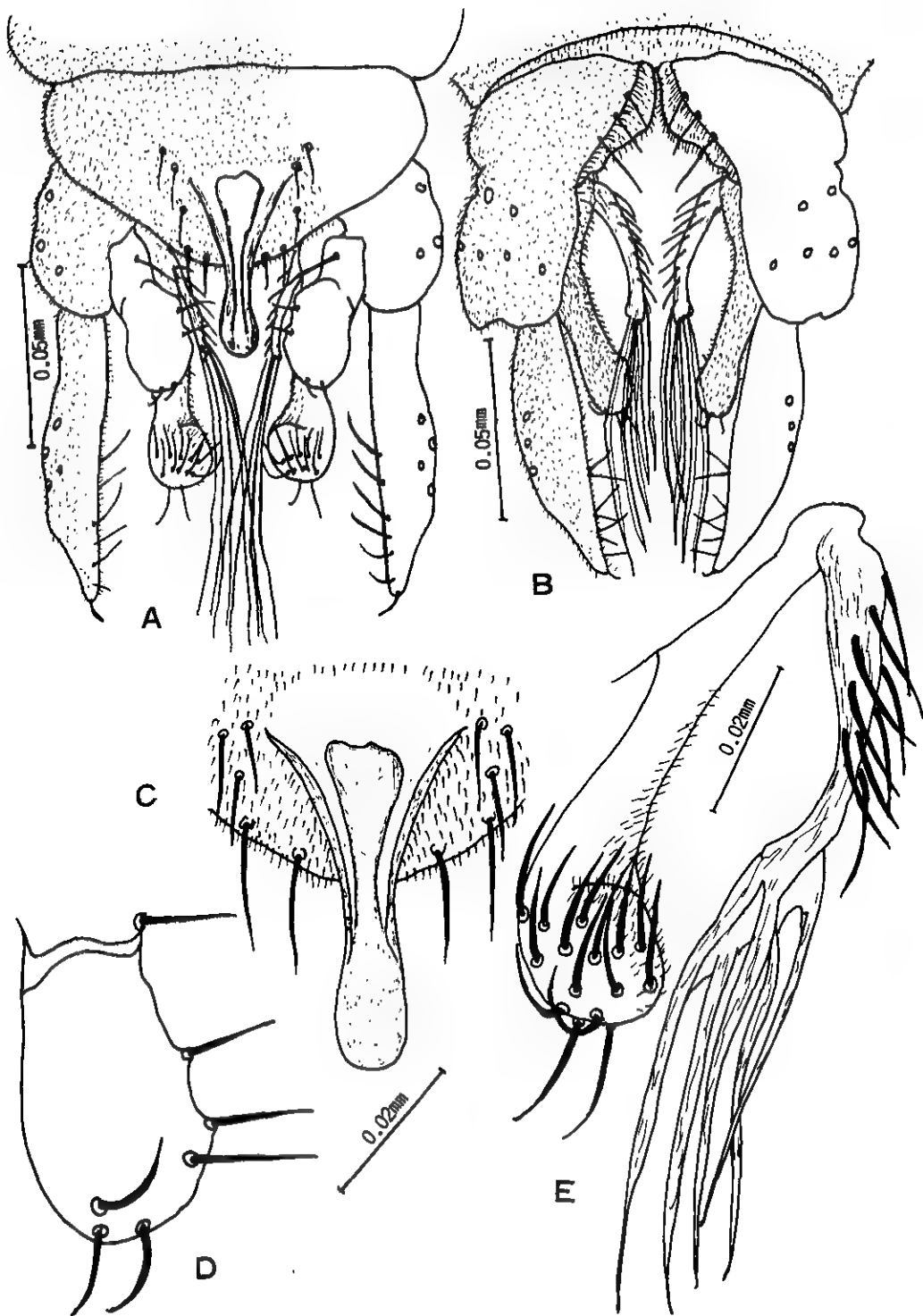


Plate 5. *Rheotanytarsus tamasecundus*, sp. nov. Male hypopygium.

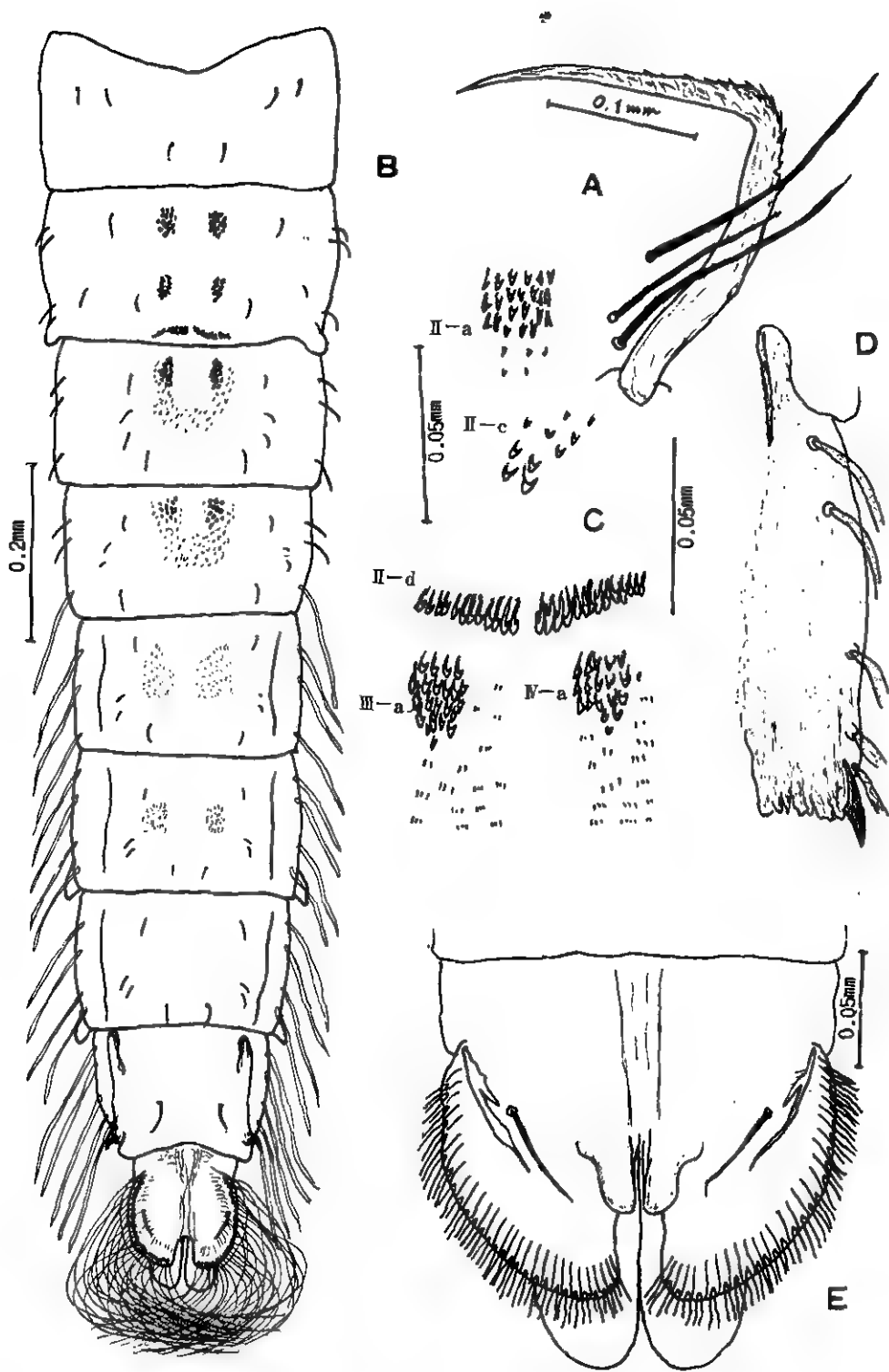


Plate 6. *Rheotanytarsus tamasecundus*, sp. nov. Pupa.

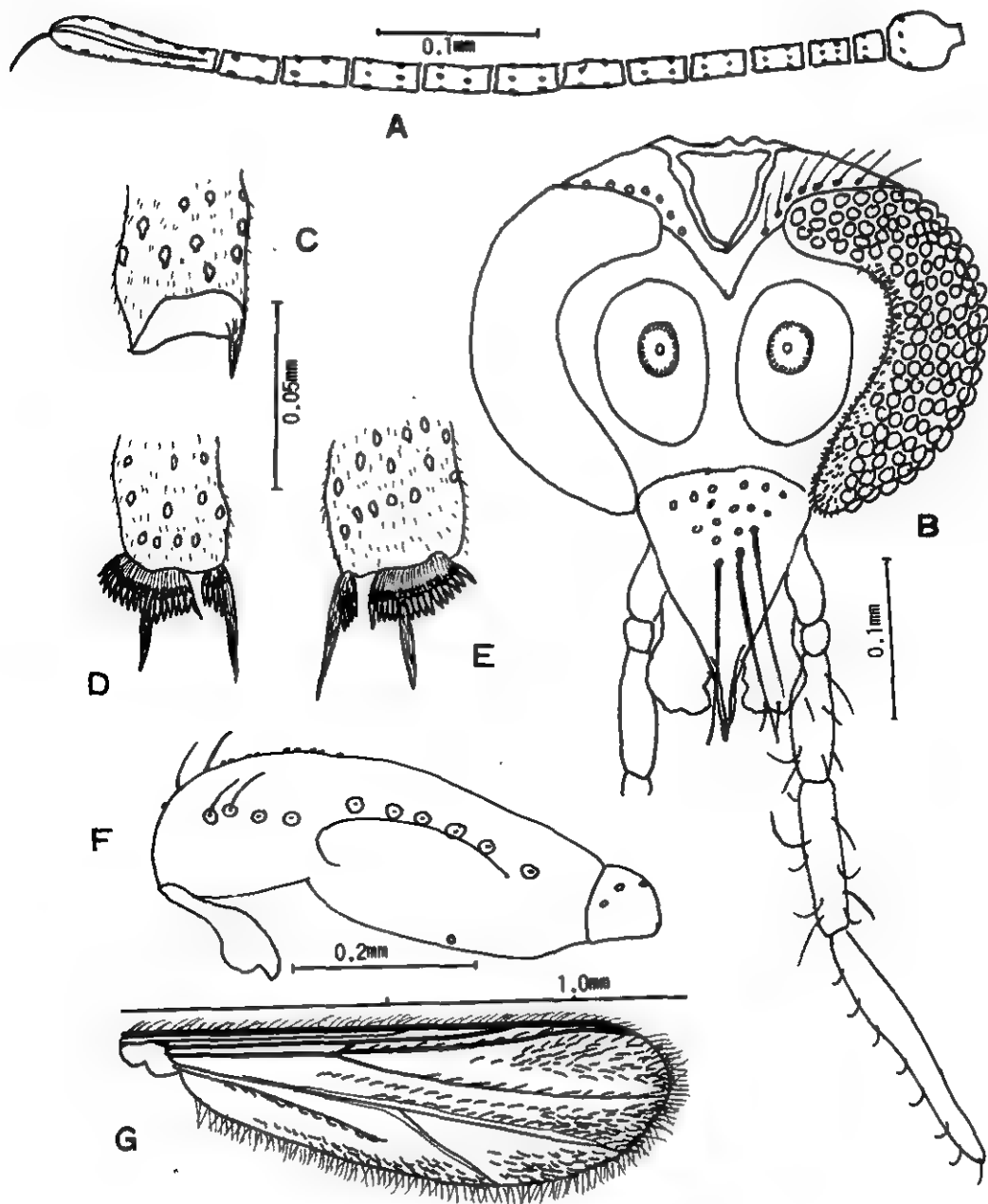


Plate 7. *Rheotanytarsus tamatertijs*, sp. nov. Male.

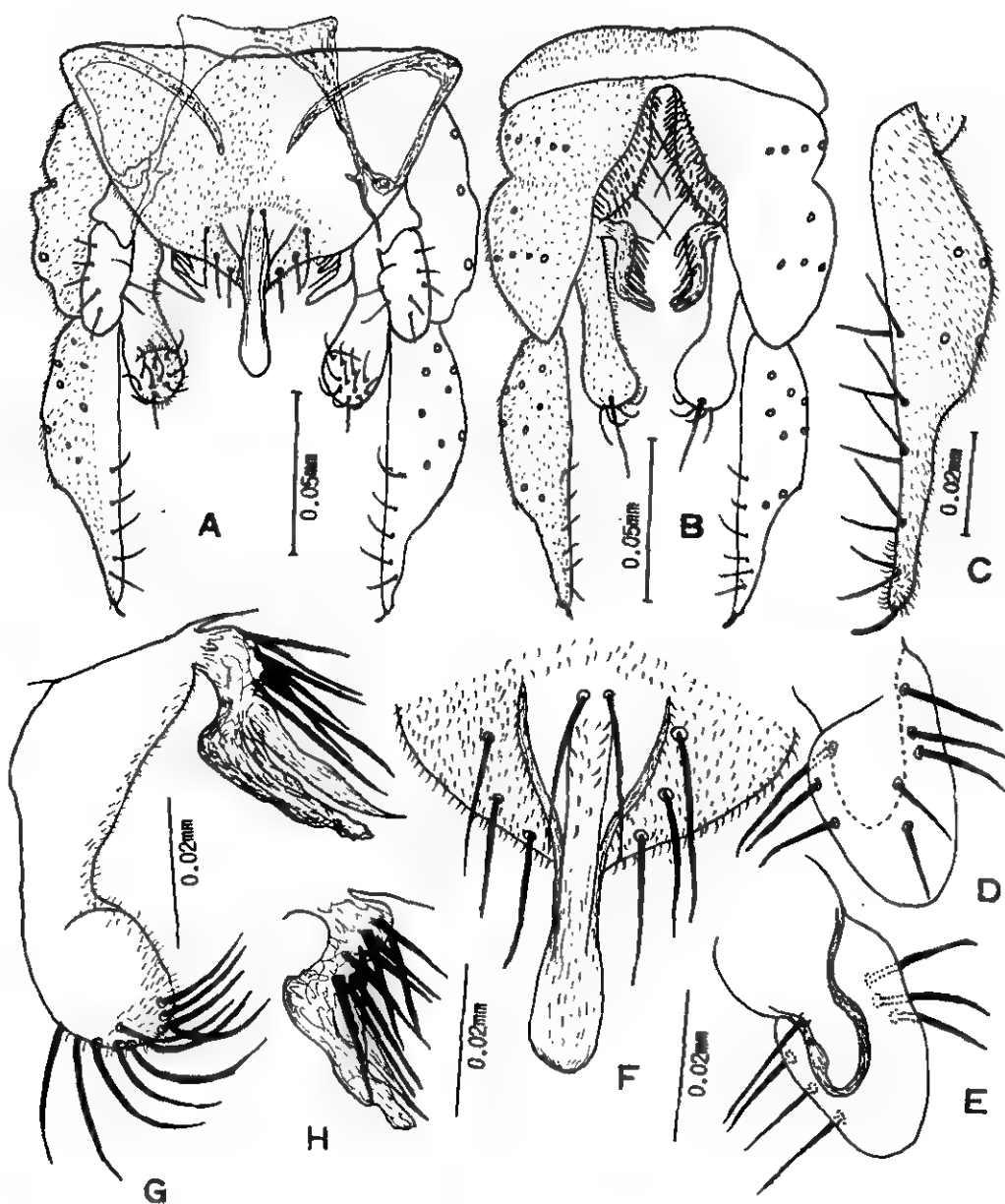


Plate 8. *Rheotanytarsus tamatertius*, sp. nov. Male hypopygium.

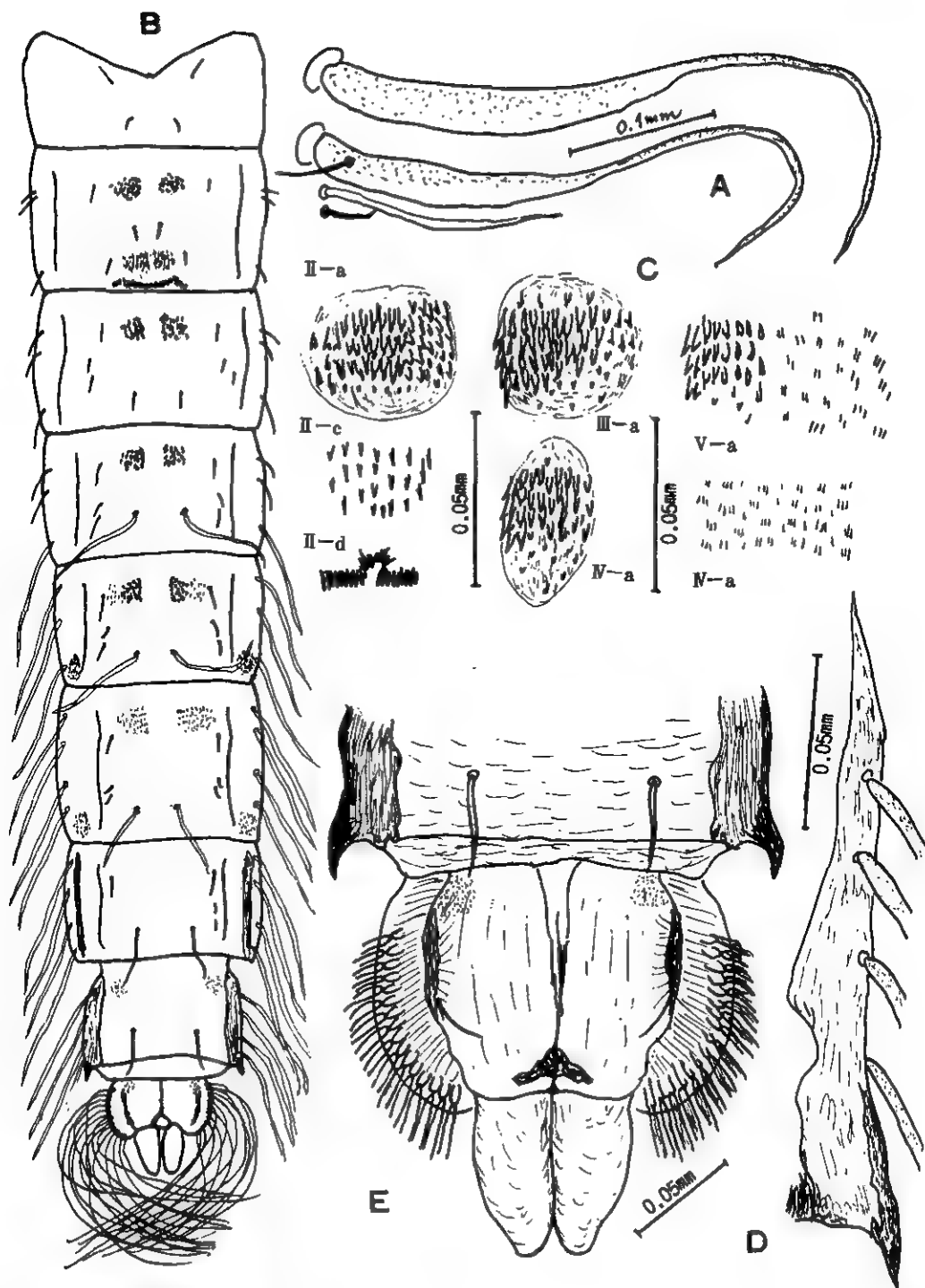


Plate 9. *Rheotanytarsus tamatertius*, sp. nov. Pupa.

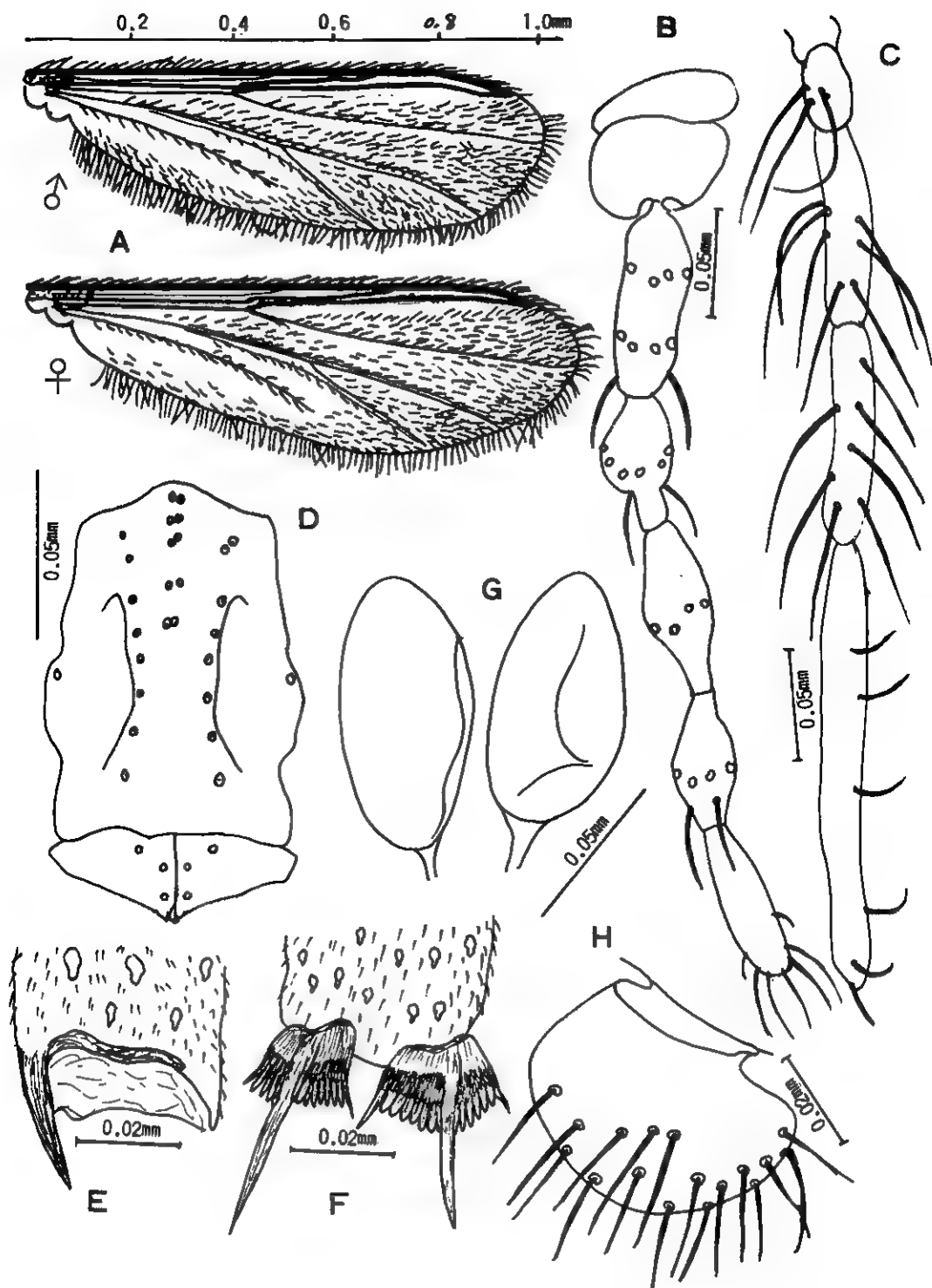


Plate 10. *Rheotanytarsus tamaquartus*, sp. nov. Adult.

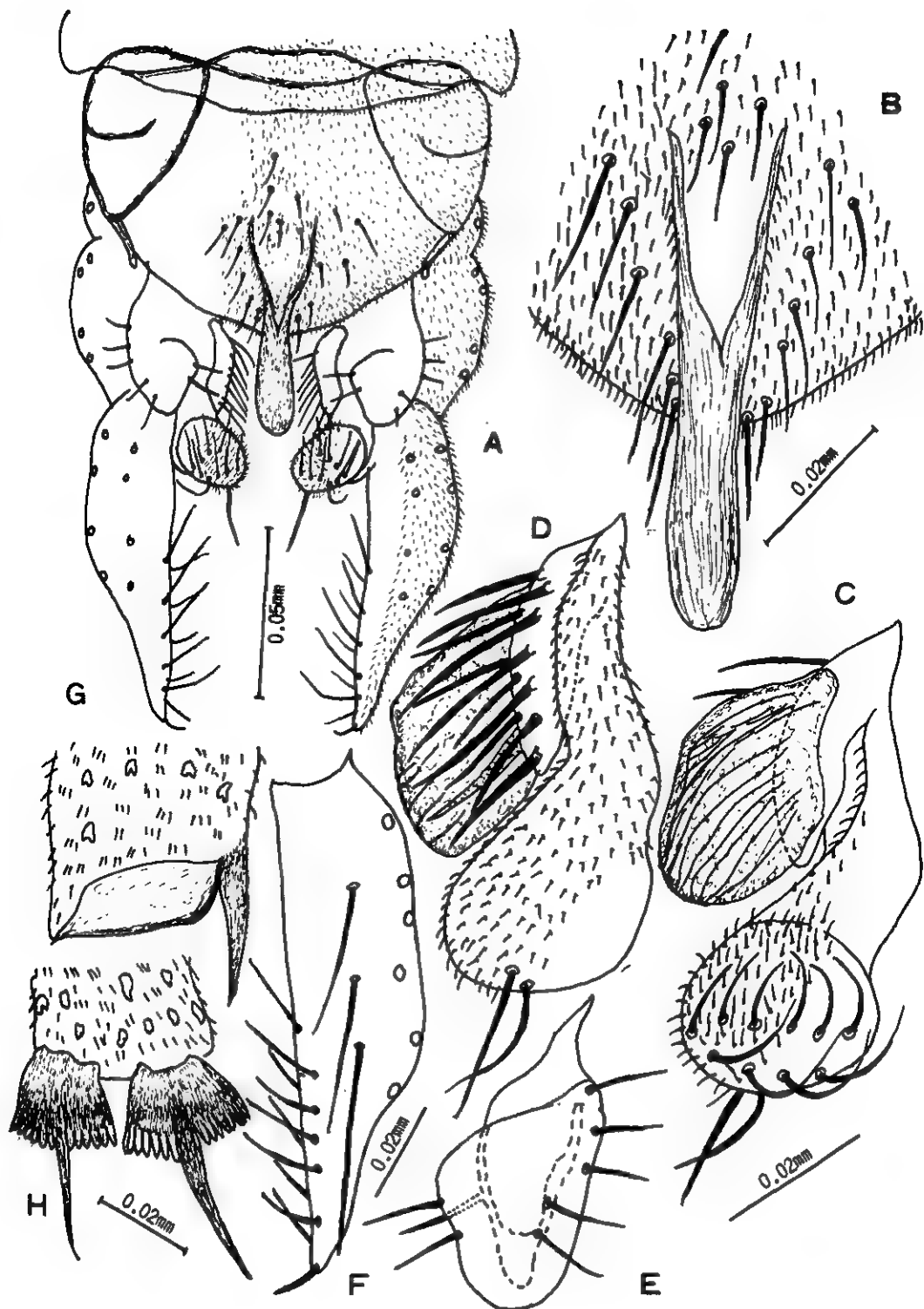


Plate 11. *Rheotanytarsus tamaquartus*, sp. nov. Male hypopygium.

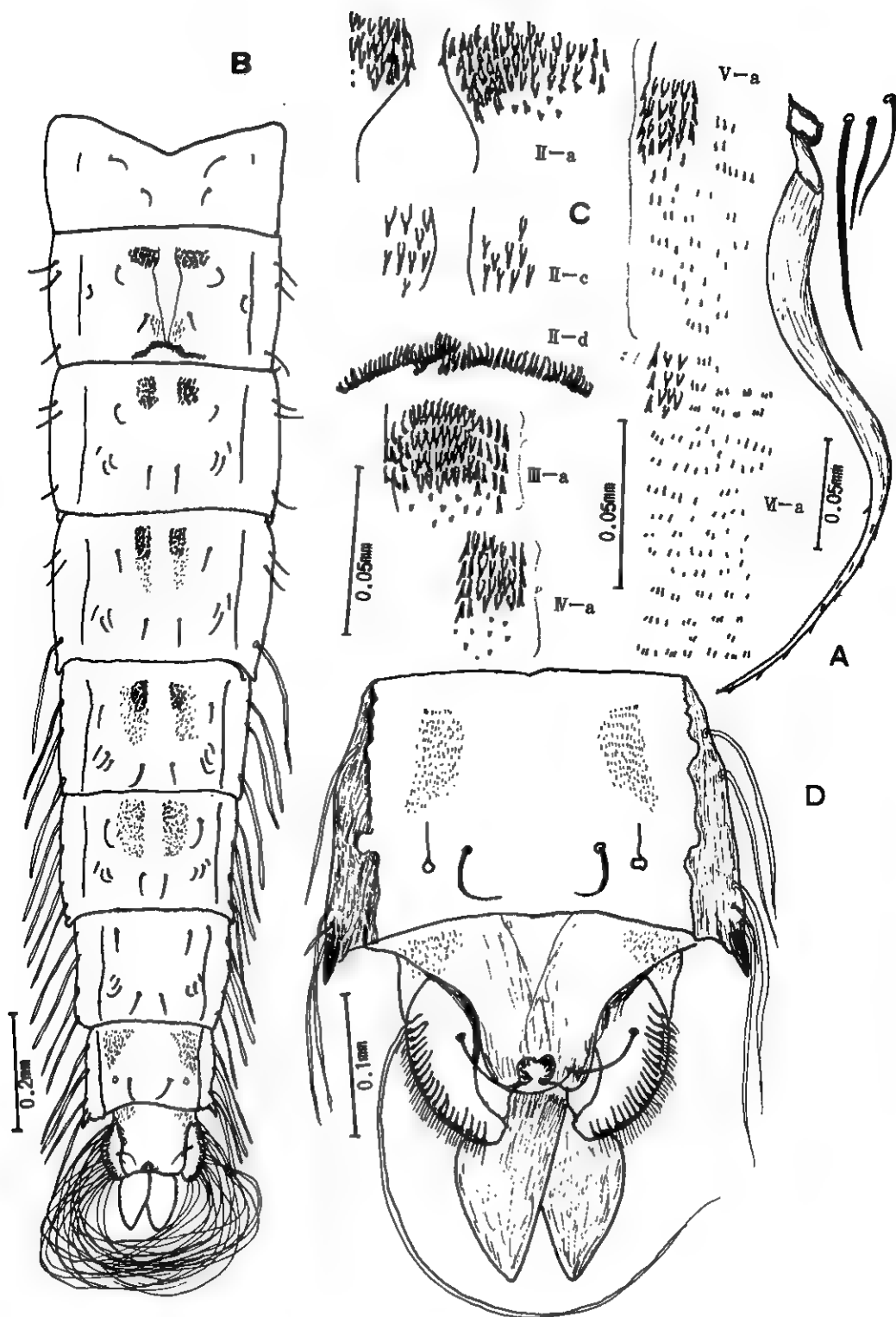


Plate 12. *Rheotanytarsus tamaquartus*, sp. nov. Pupa.

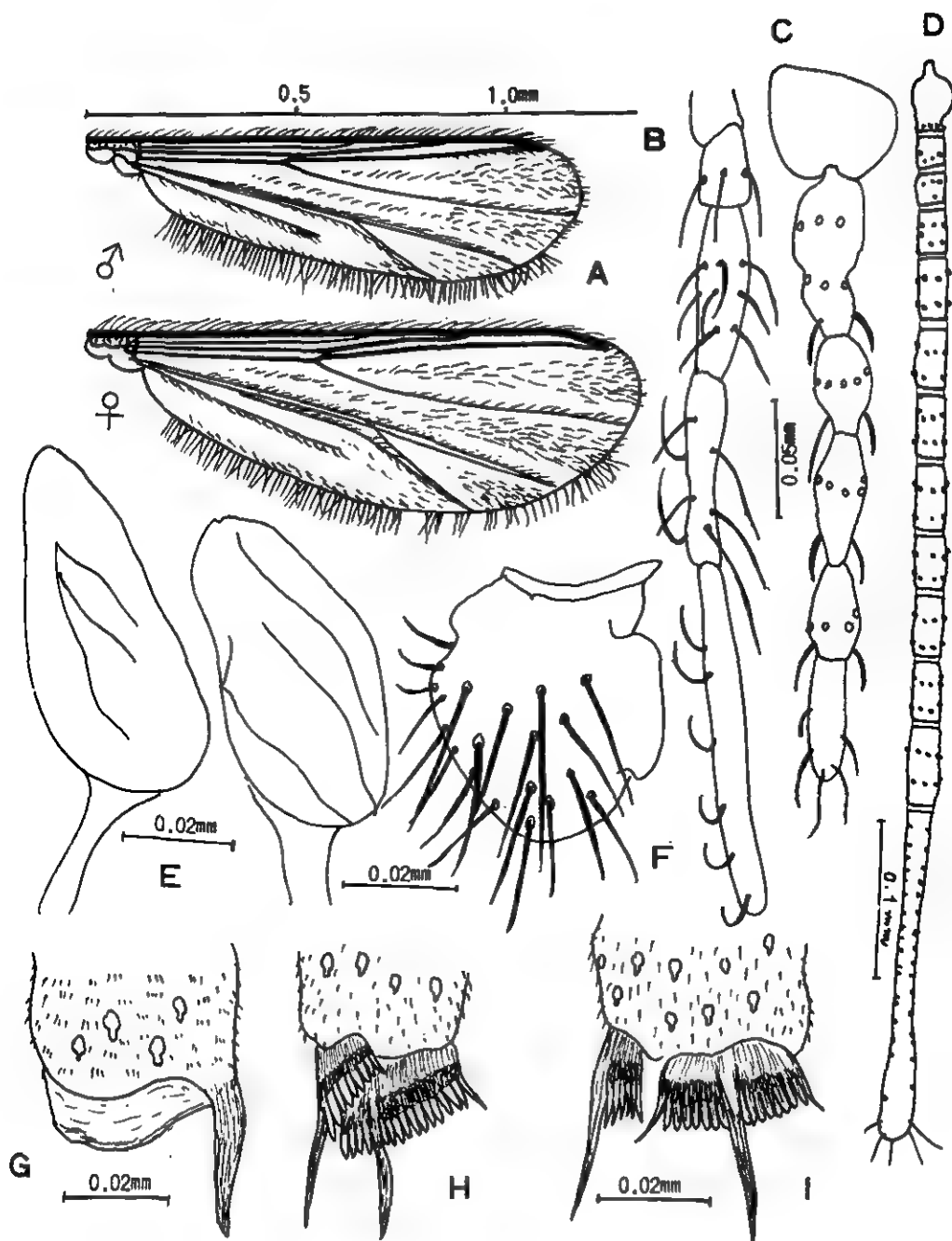


Plate 13. *Rheotanytarsus tamaquintus*, sp. nov. Adult.

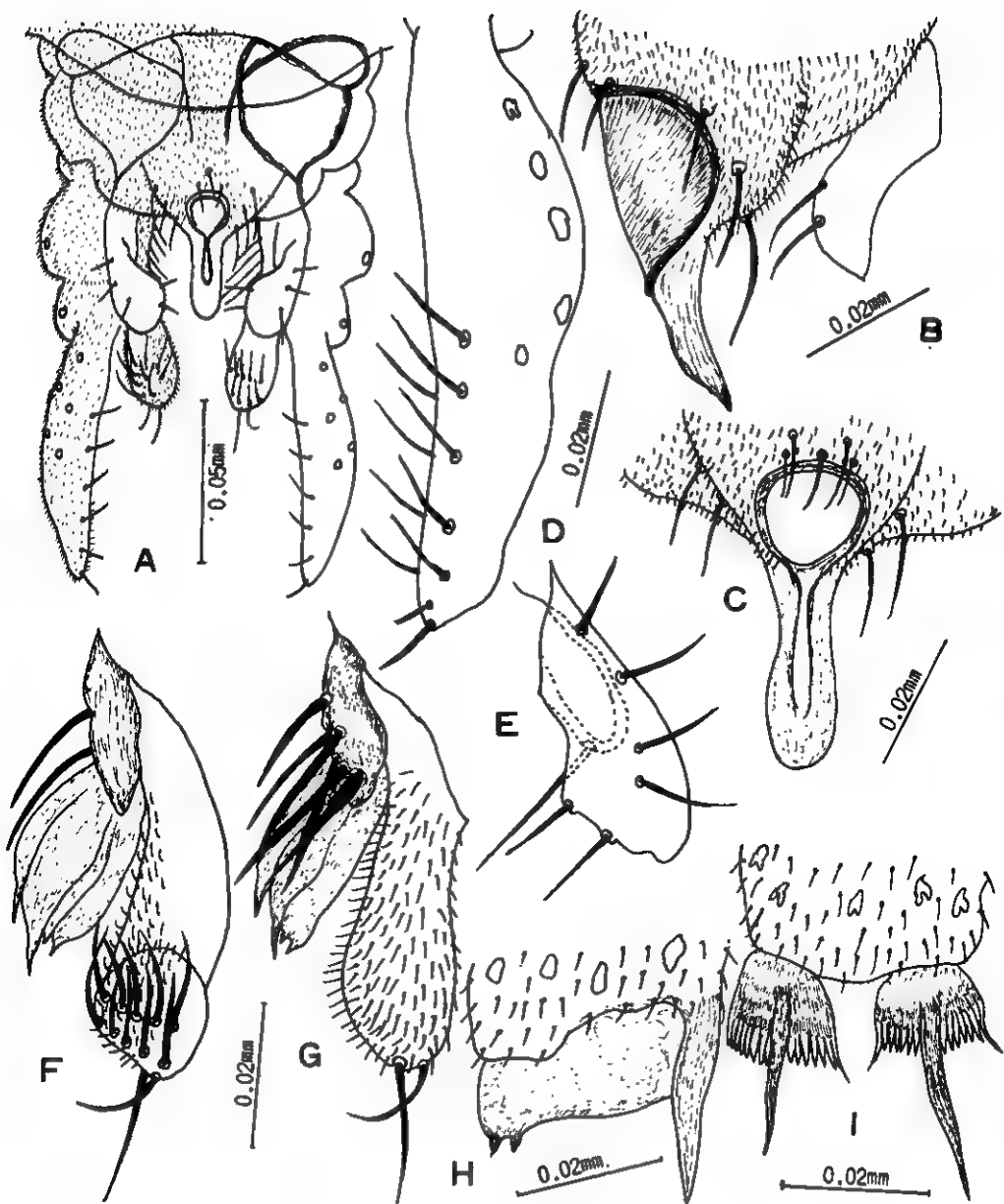


Plate 14. *Rheotanytarsus tamaquintus*, sp. nov. Male.

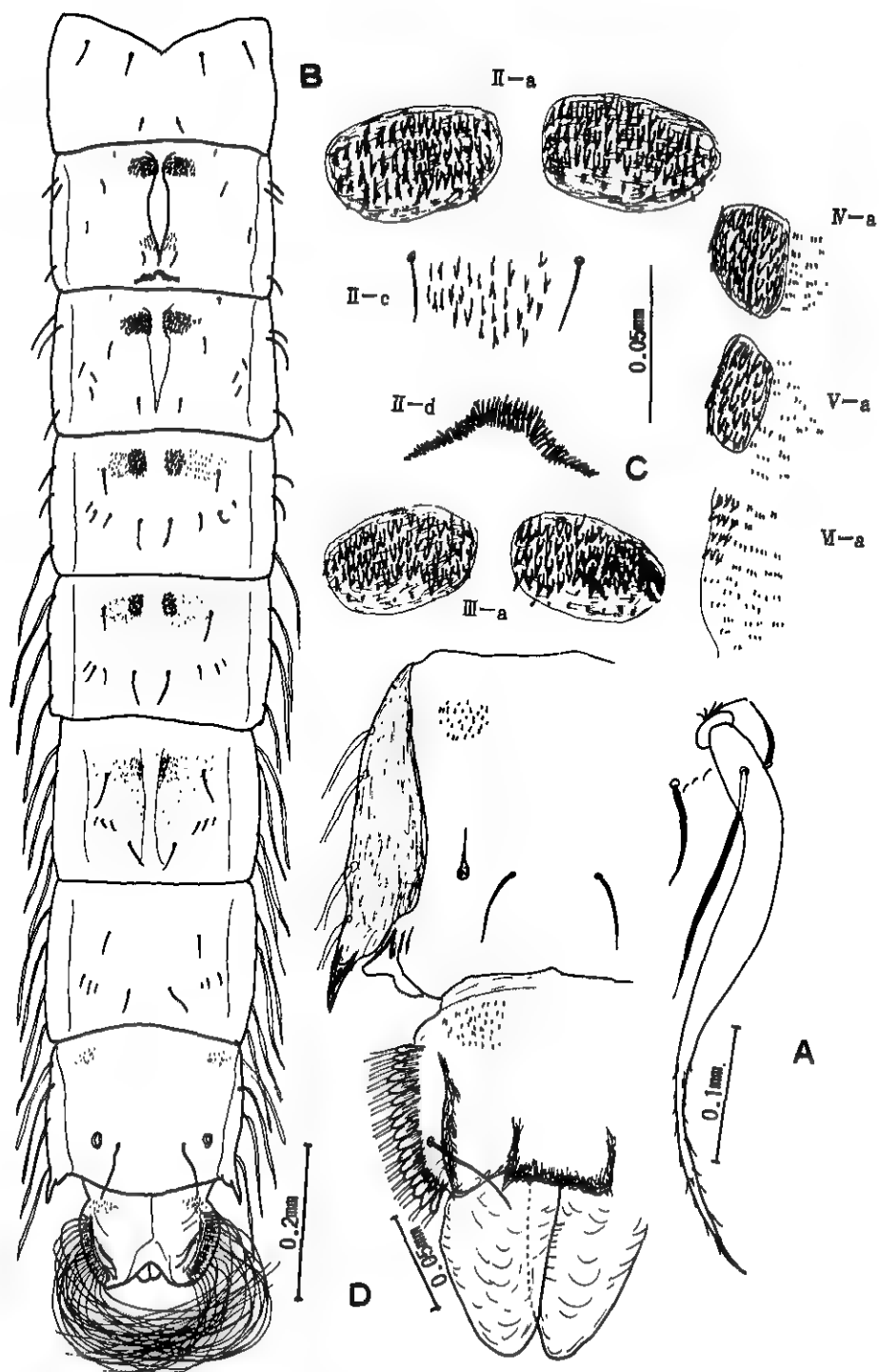


Plate 15. *Rheotanytarsus tamaquintus*, sp. nov. Pupa.

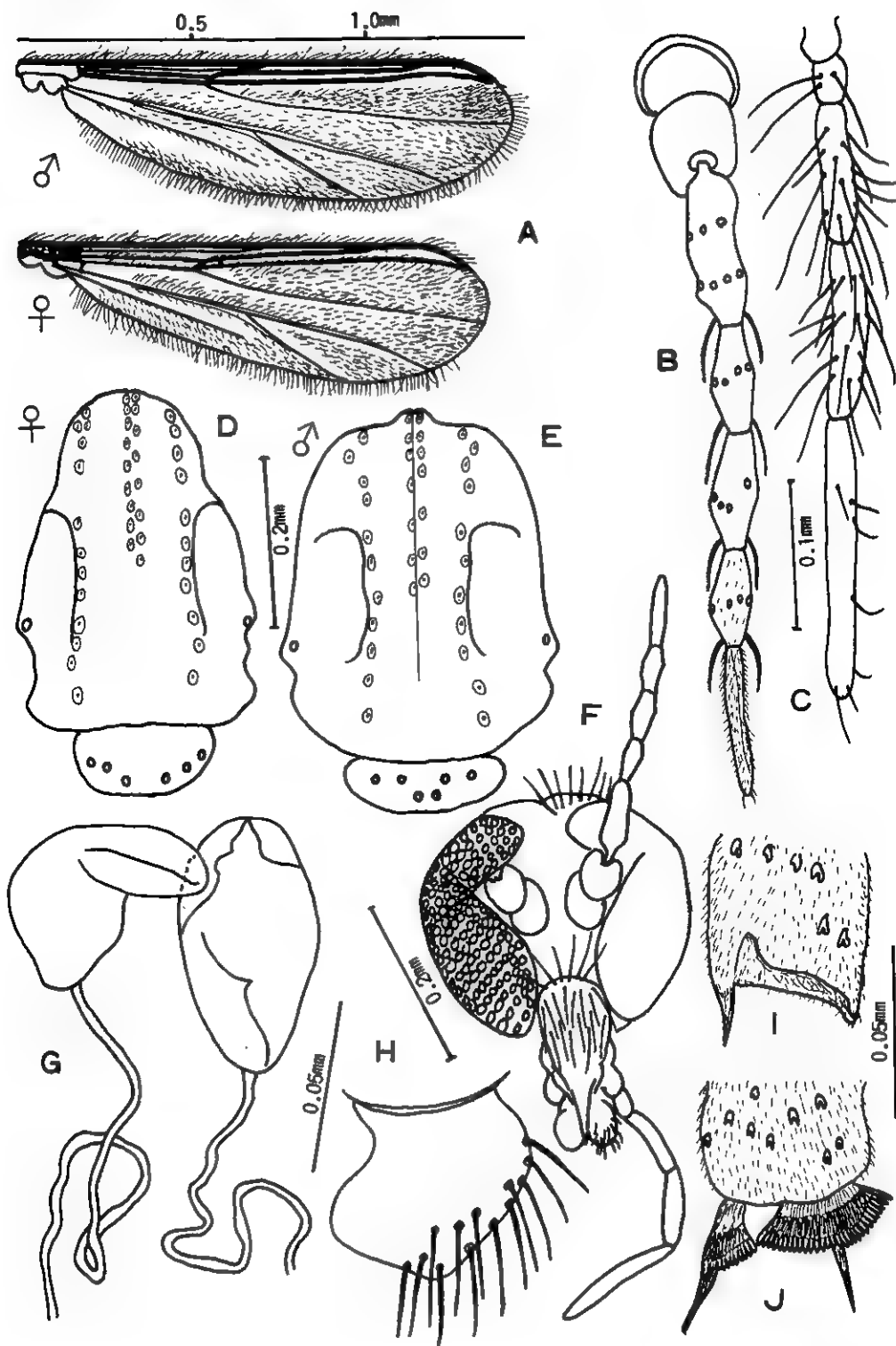


Plate 16. *Rheotanytarsus kyotoensis* (Tokunaga, 1938) Adult.

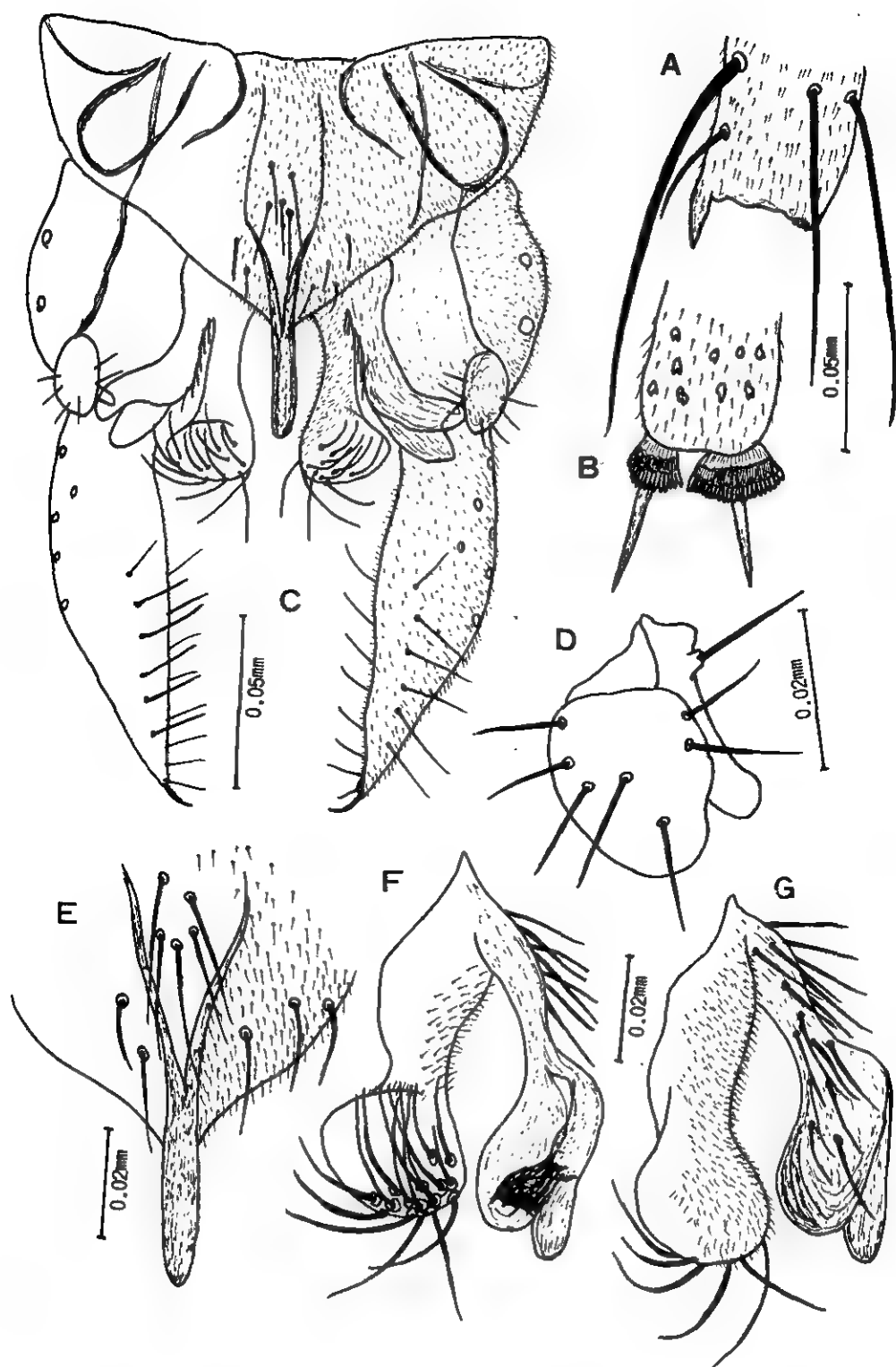


Plate 17. *Rheotanytarsus kyotoensis* (Tokunaga, 1938) Male.

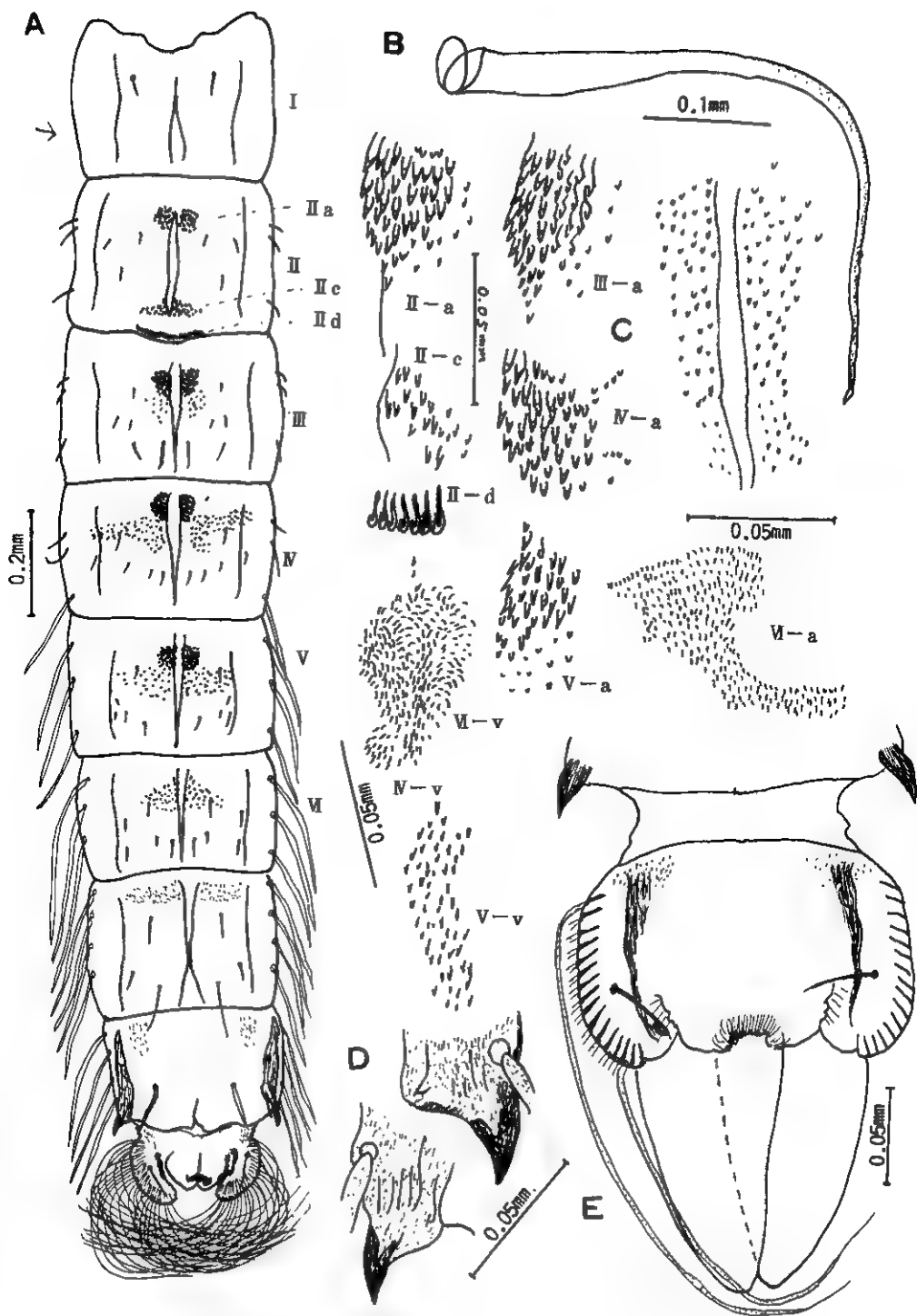


Plate 18. *Rheotanytarsus kyotoensis* (Tokunaga, 1938) Pupa.

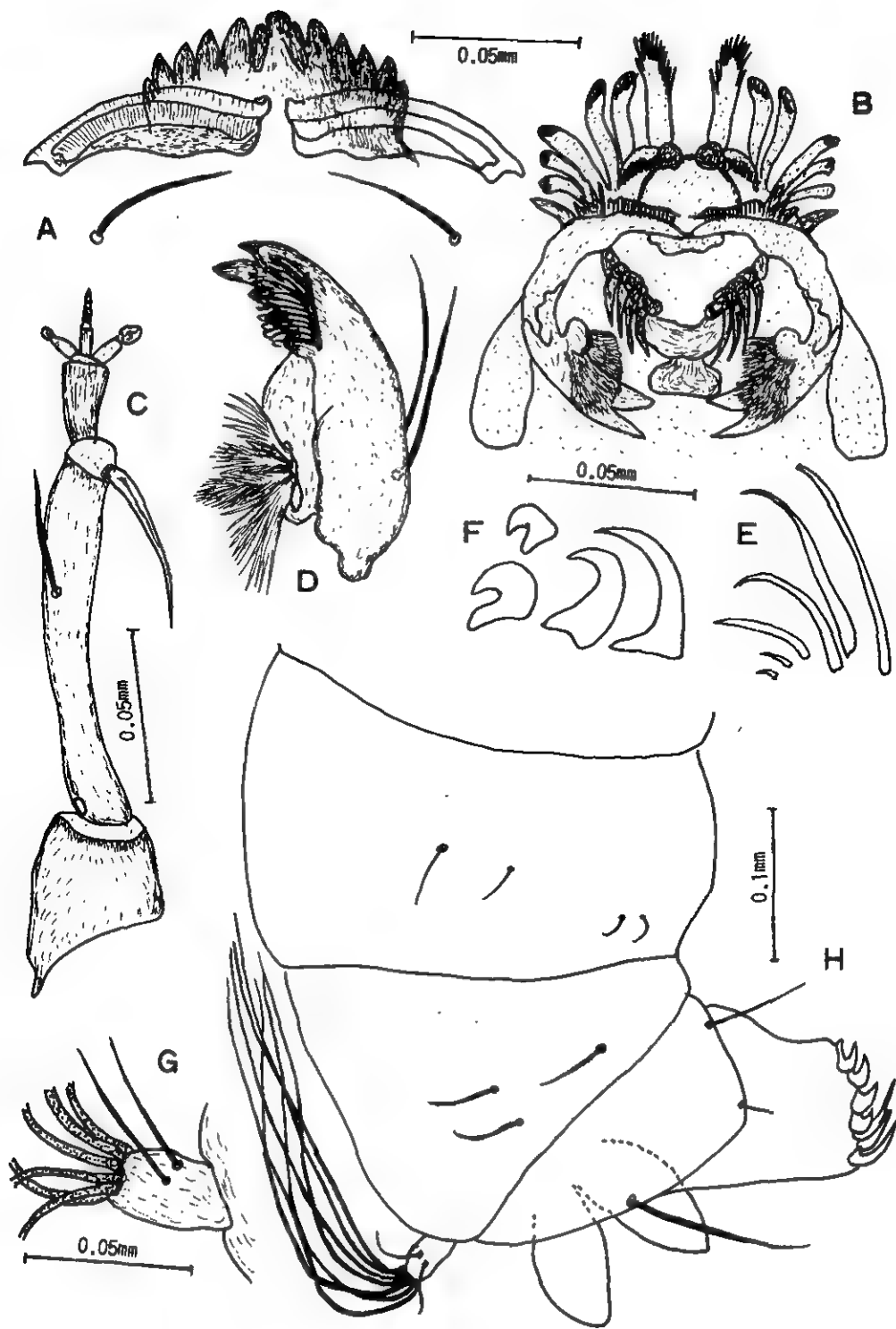


Plate 19. *Rheotanytarsus kyotoensis* (Tokunaga, 1938) Larva.

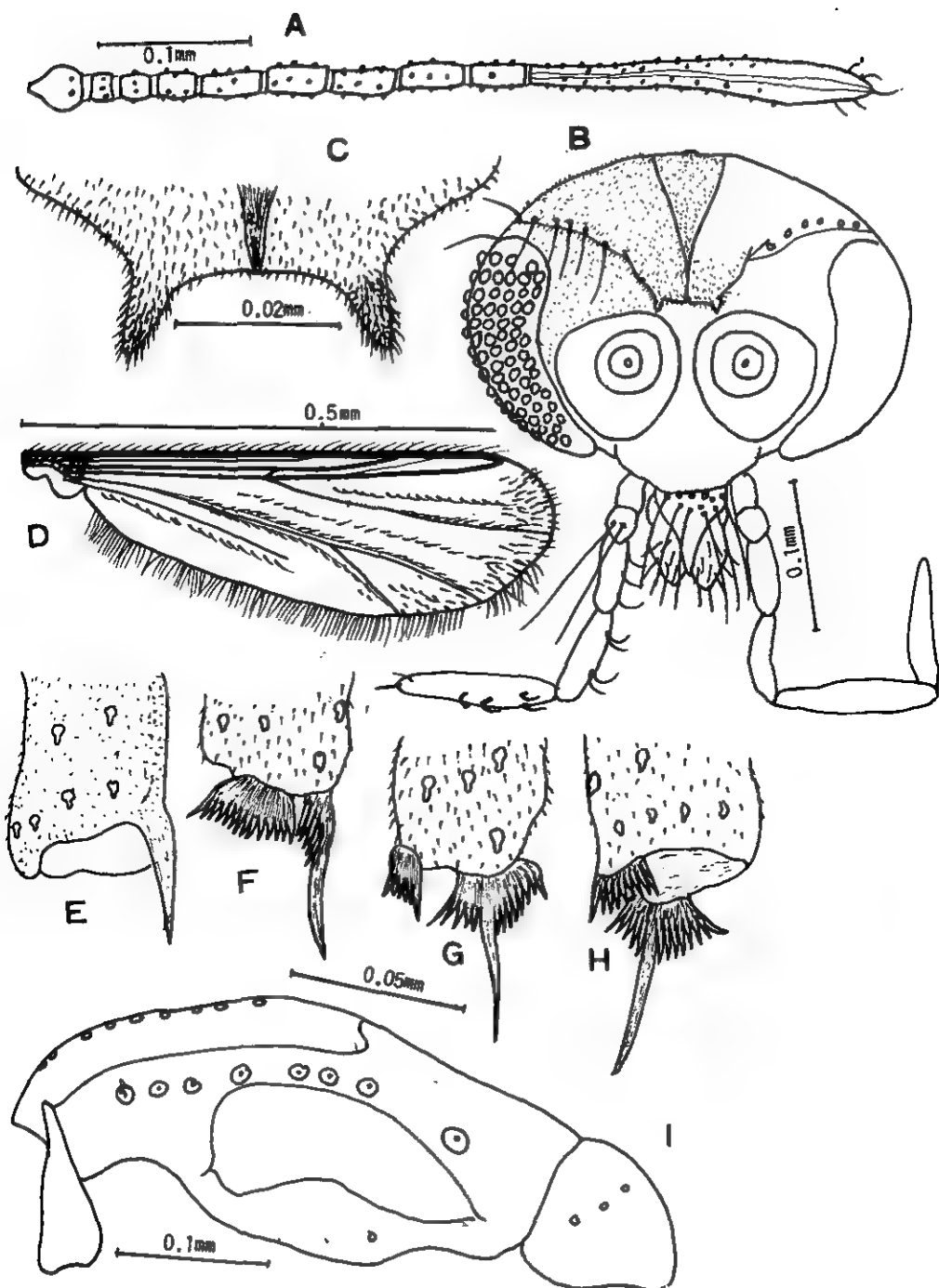


Plate 20. *Tanytarsus tamaseptimus*, sp. nov. Male.

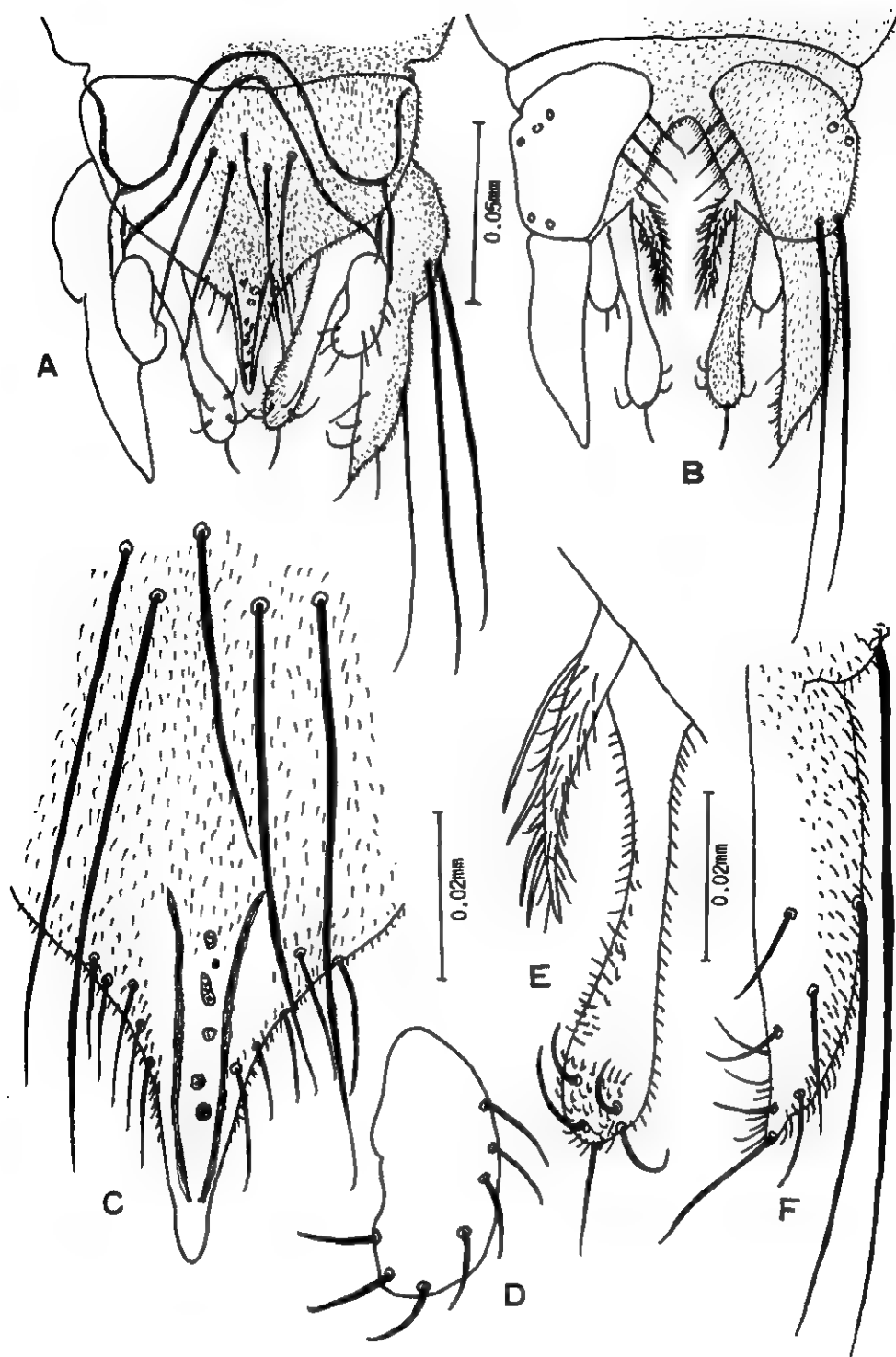


Plate 21. *Tanytarsus tamaseptimus*, sp. nov. Male hypopygium.

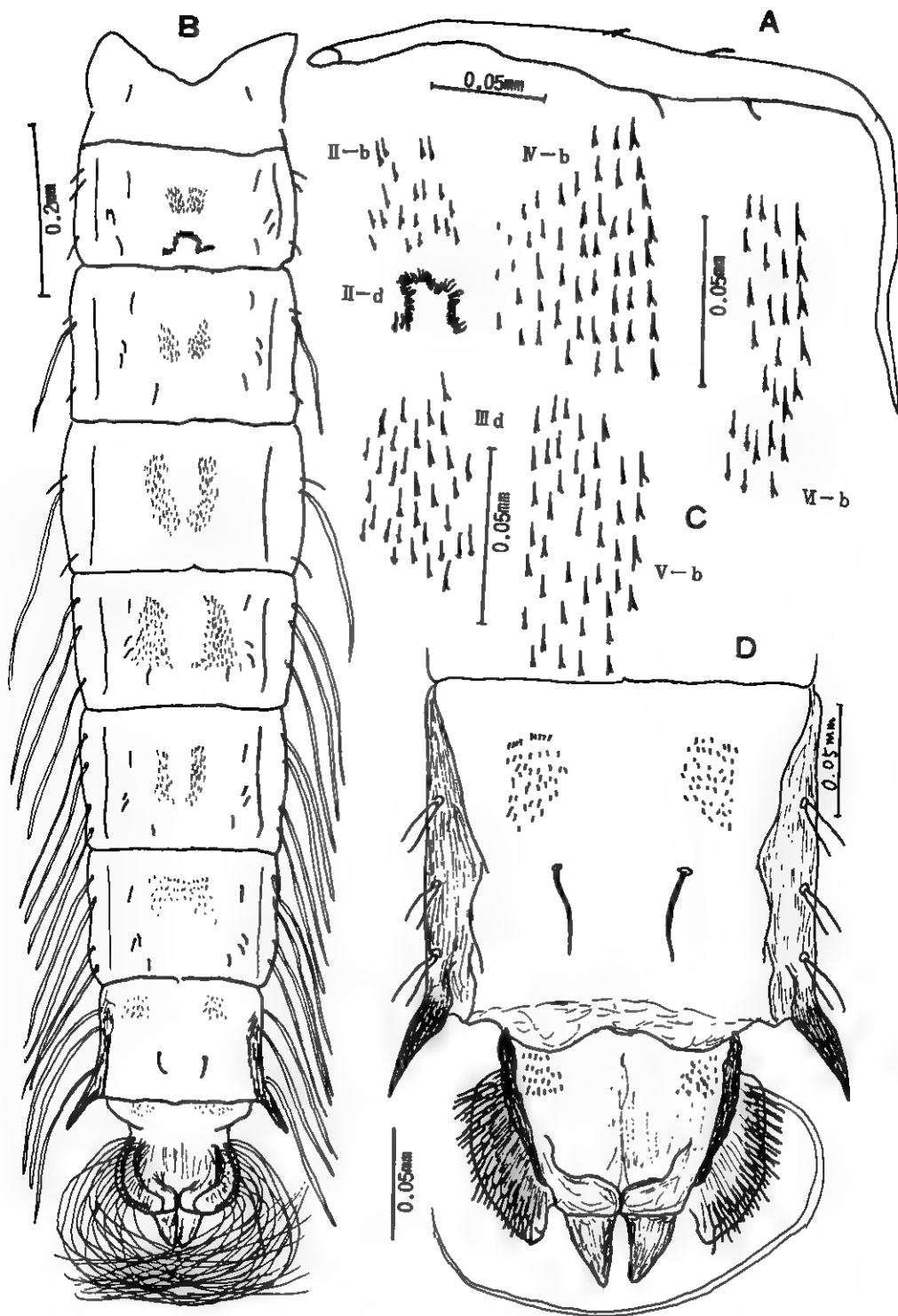


Plate 22. *Tanytarsus tamaseptimus*, sp. nov. Pupa.

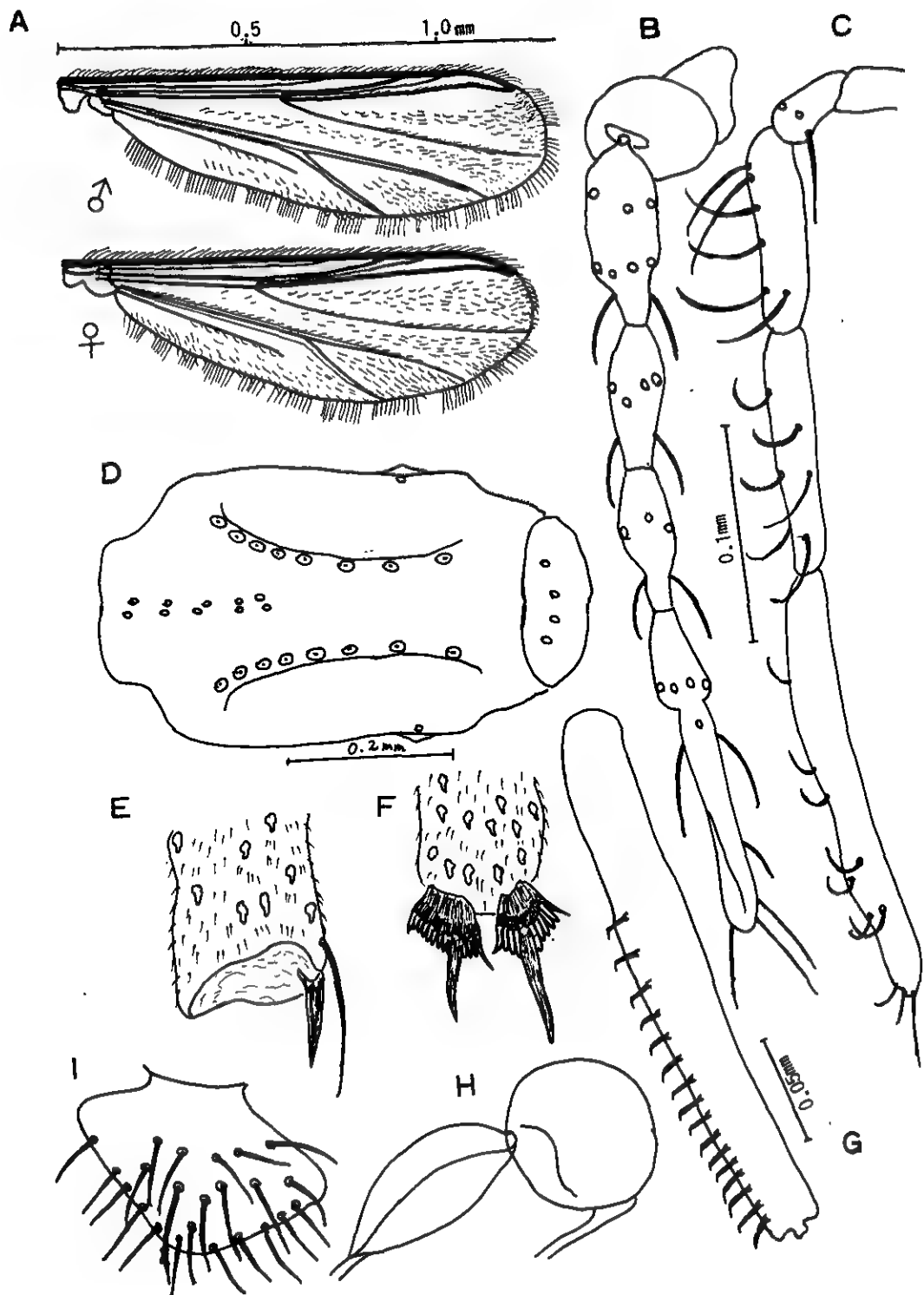


Plate 23. *Tanytarsus tamaoctavus*, sp. nov. Adult.

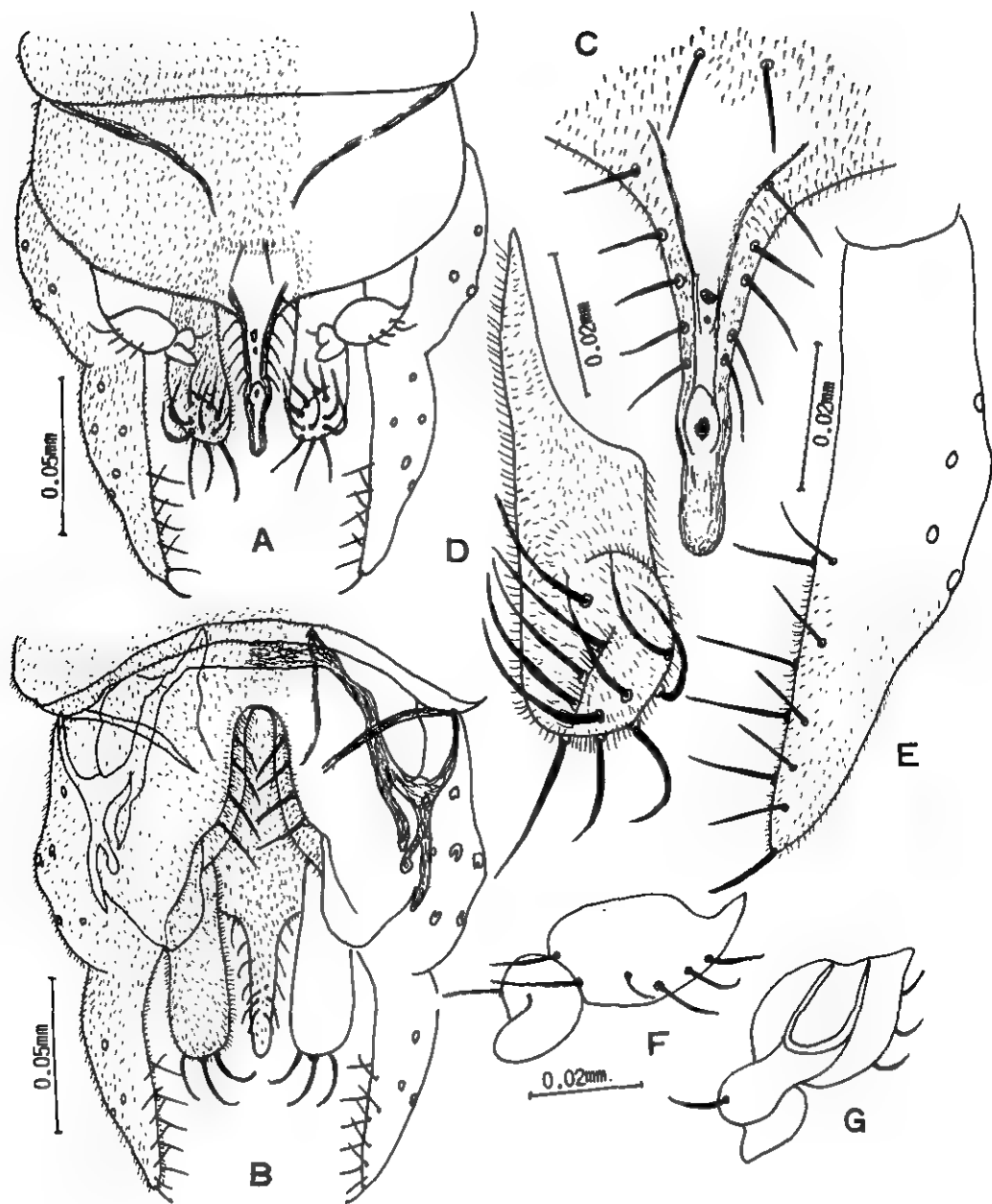


Plate 24. *Tanytarsus tamaoctavus*, sp. nov. Male hypopygium.

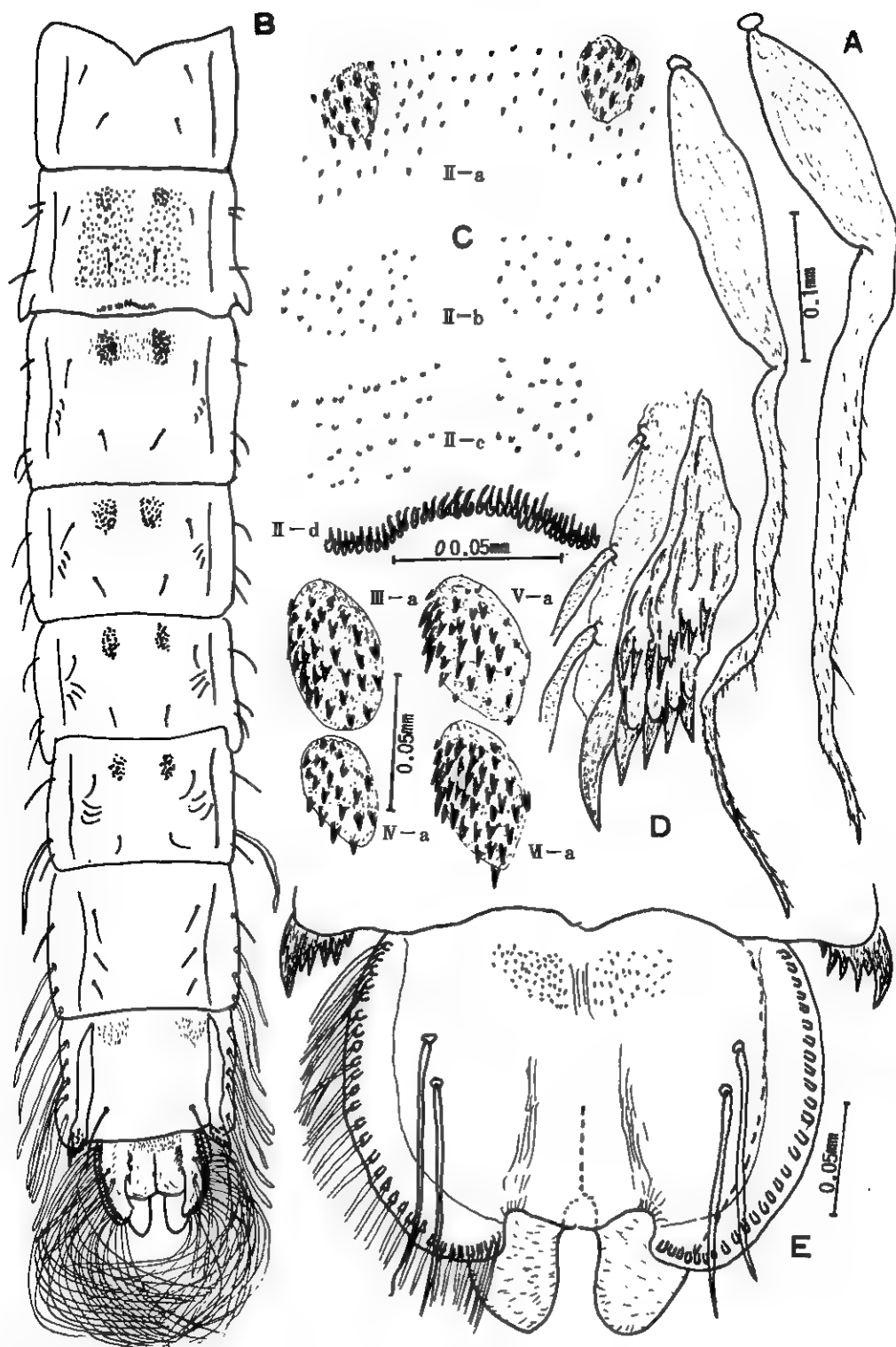


Plate 25. *Tanytarsus tamaoctavus*, sp. nov. Pupa.

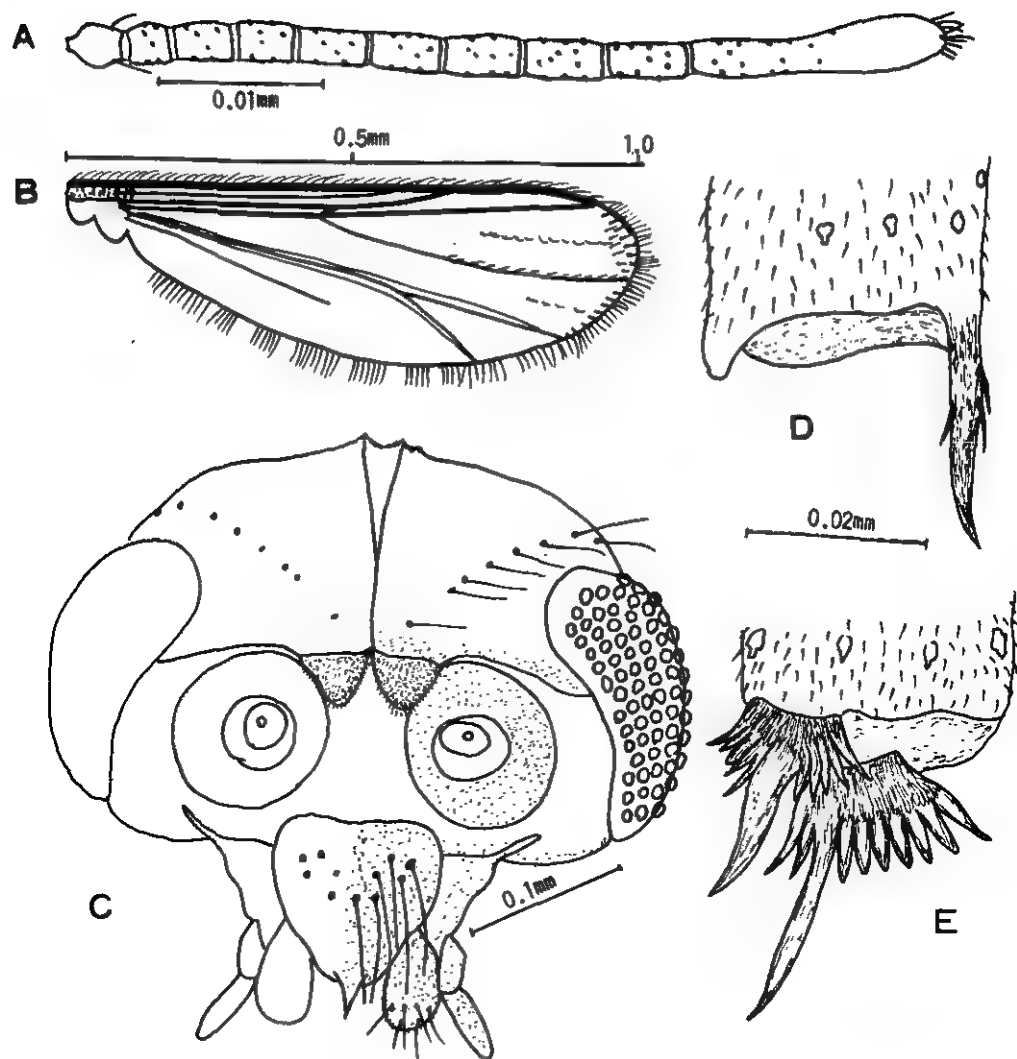


Plate 26. *Tanytarsus tamanonus*, sp. nov. Male.

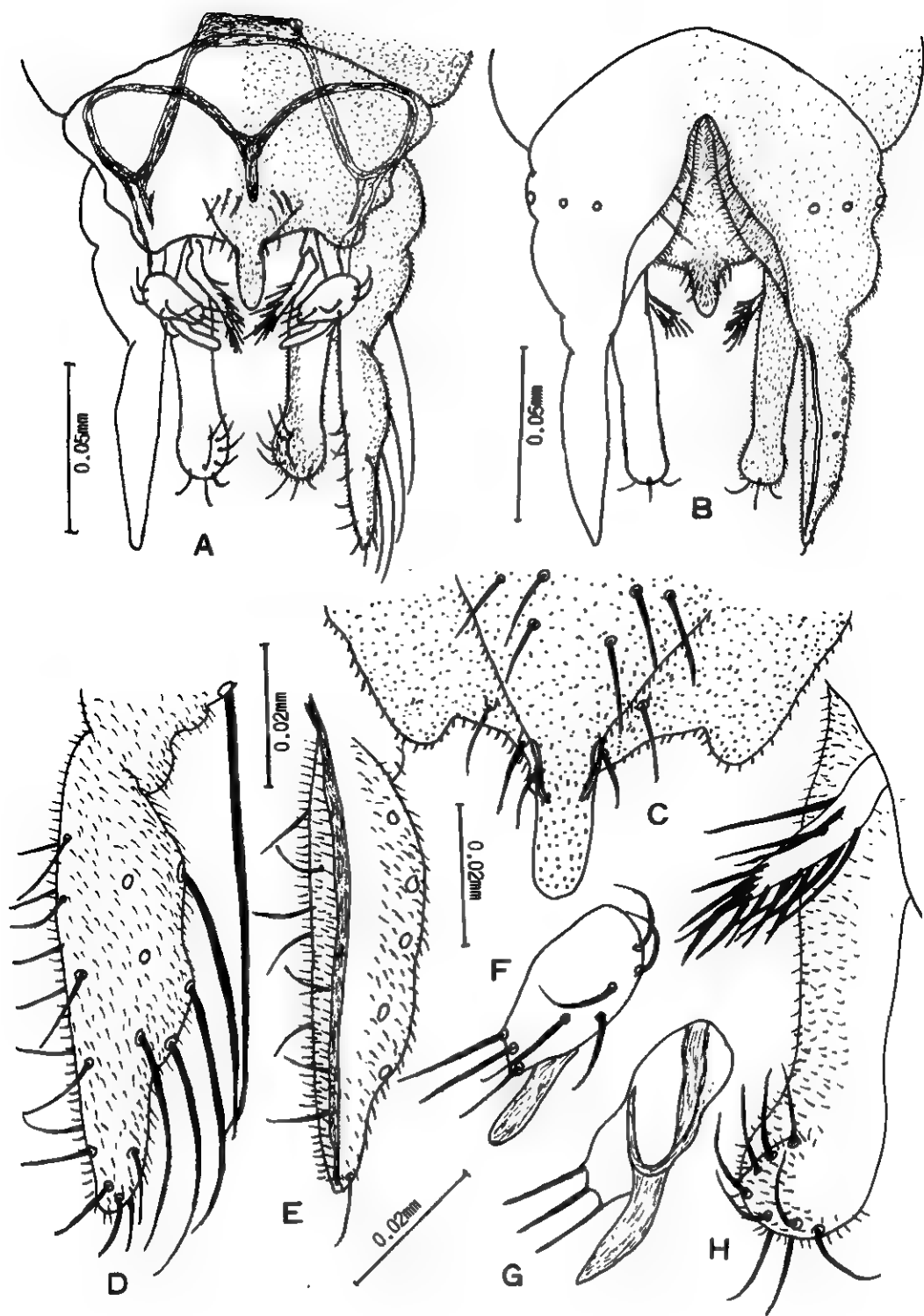


Plate 27. *Tanytarsus tamanonus*, sp. nov. Male hypopygium.

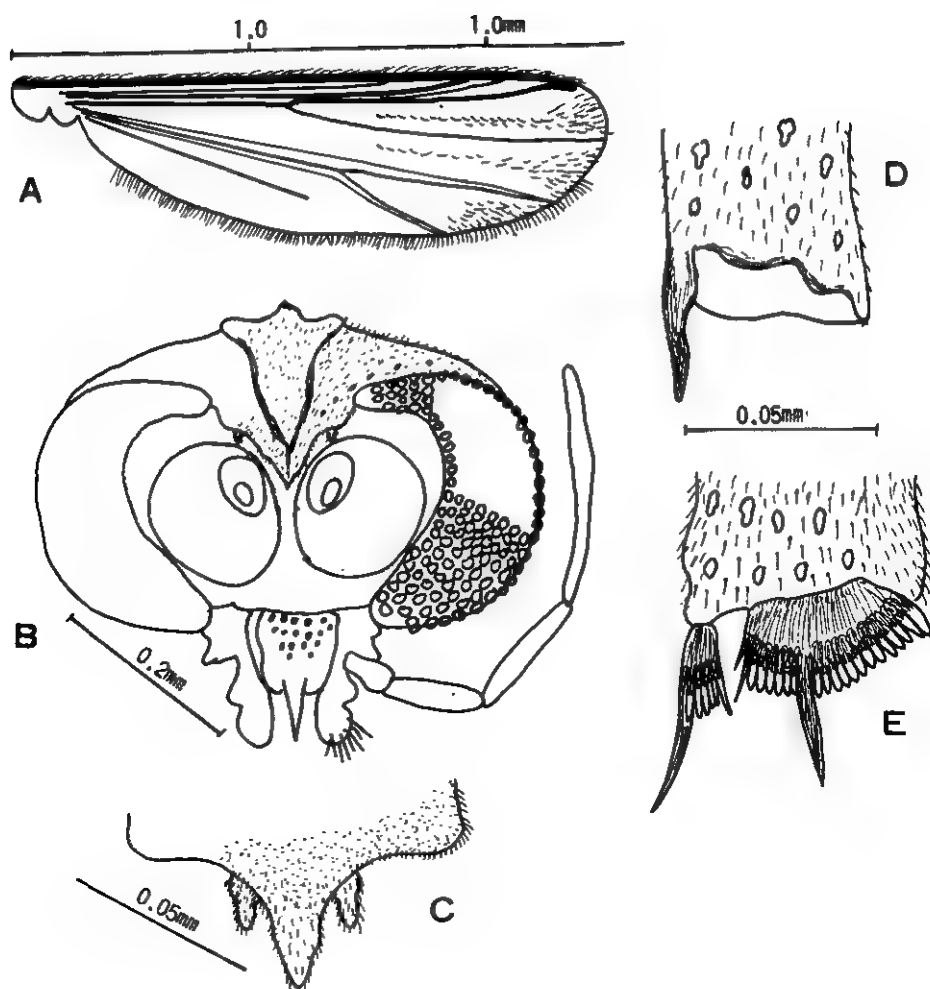


Plate 28. *Tanytarsus tamadecimus*, sp. nov. Male.

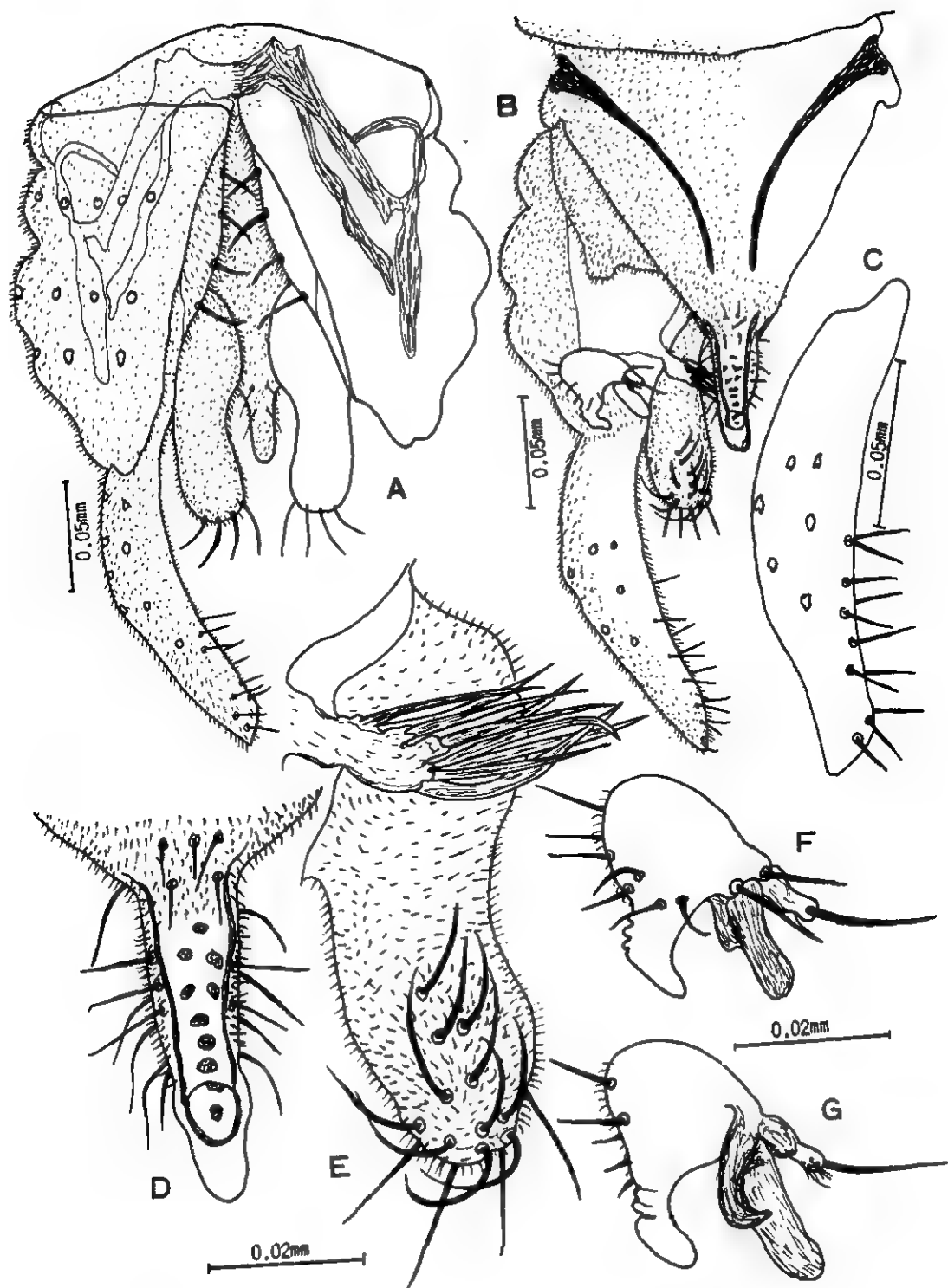


Plate 29. *Tanytarsus tamadecimus*, sp. nov. Male hypopygium.

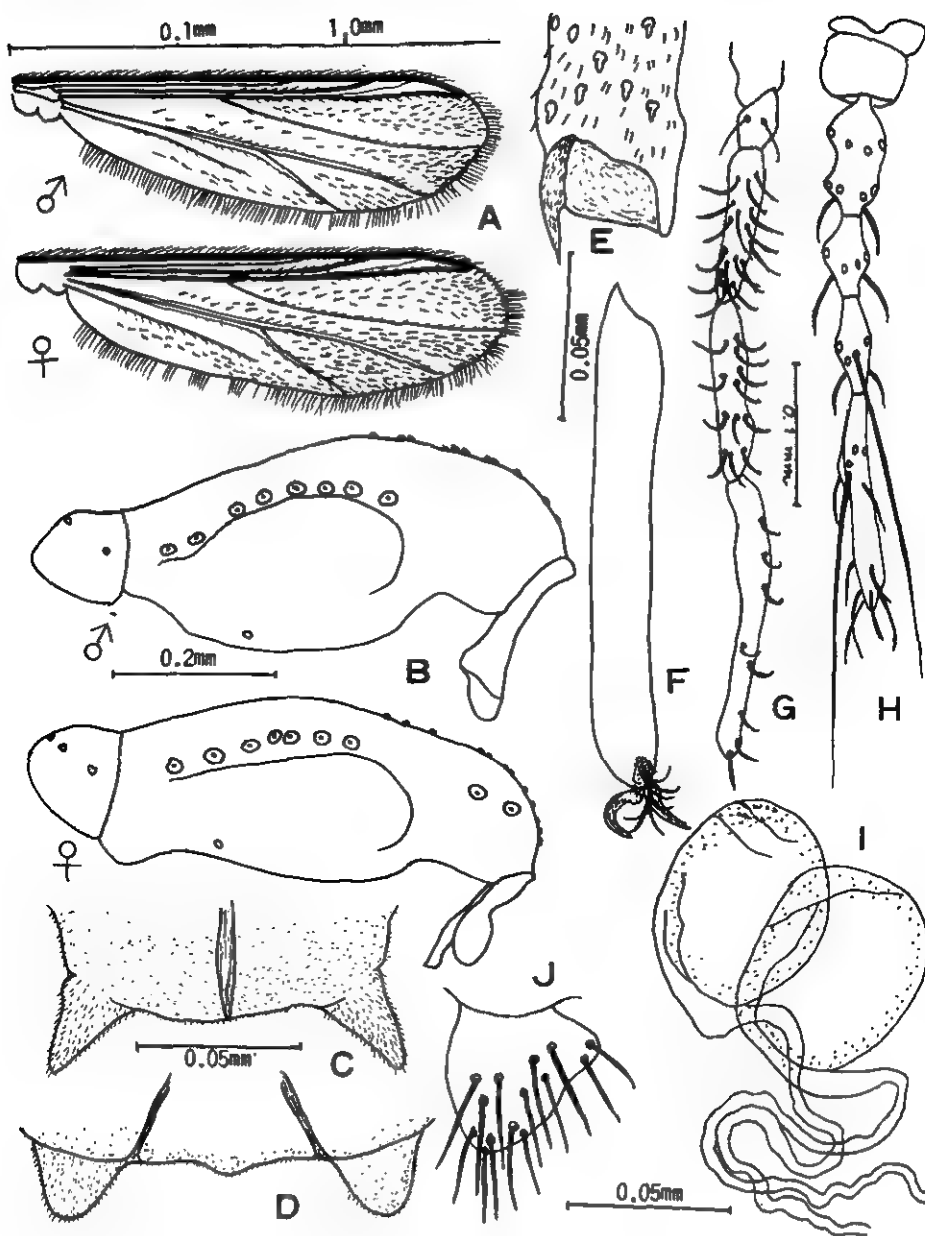


Plate 30. *Tanytarsus tamaundecimus*, sp. nov. Adult.

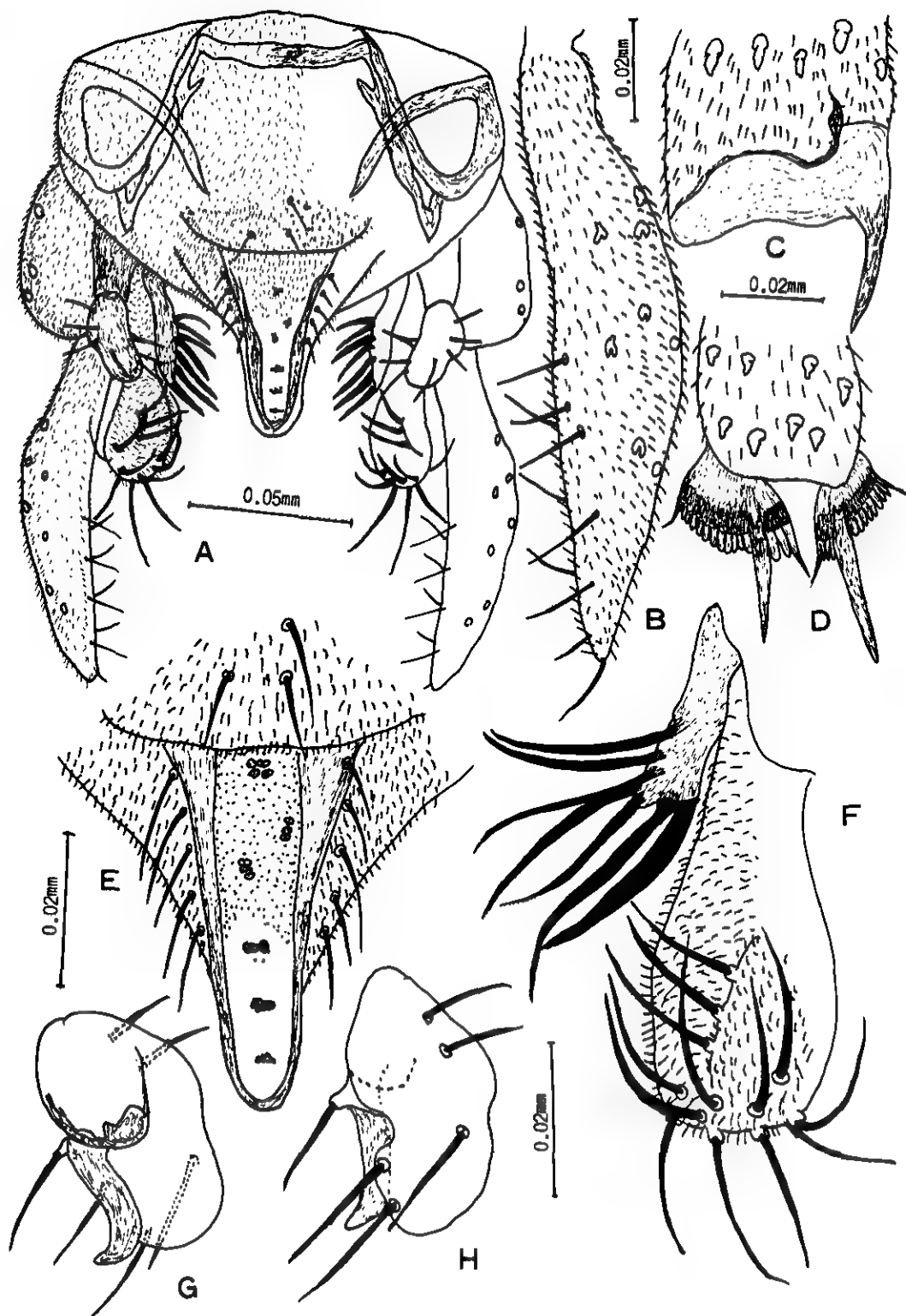


Plate 31. *Tanytarsus tamaundecimus*, sp. nov. Male.

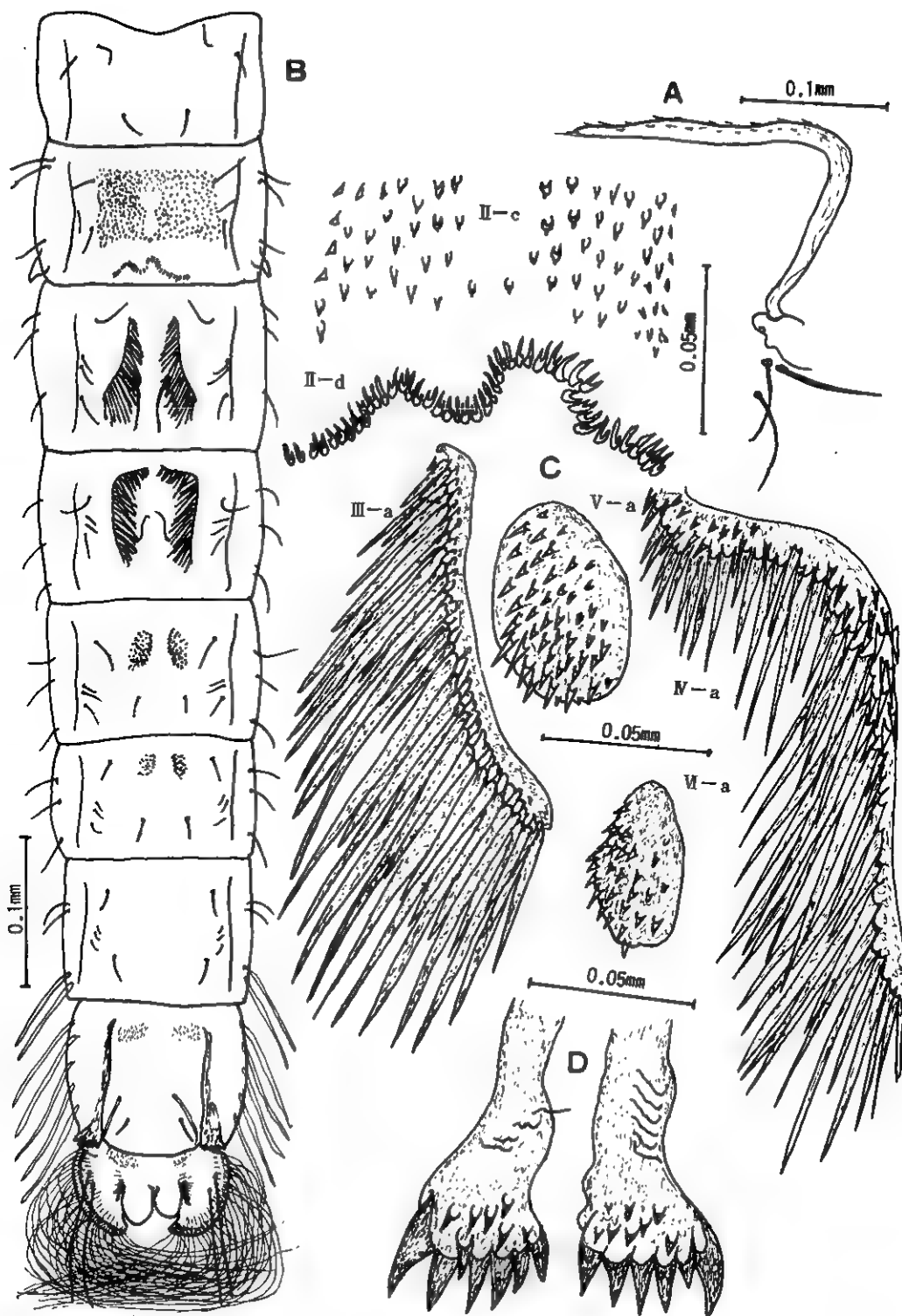


Plate 32. *Tanytarsus tamaundecimus*, sp. nov. Pupa.

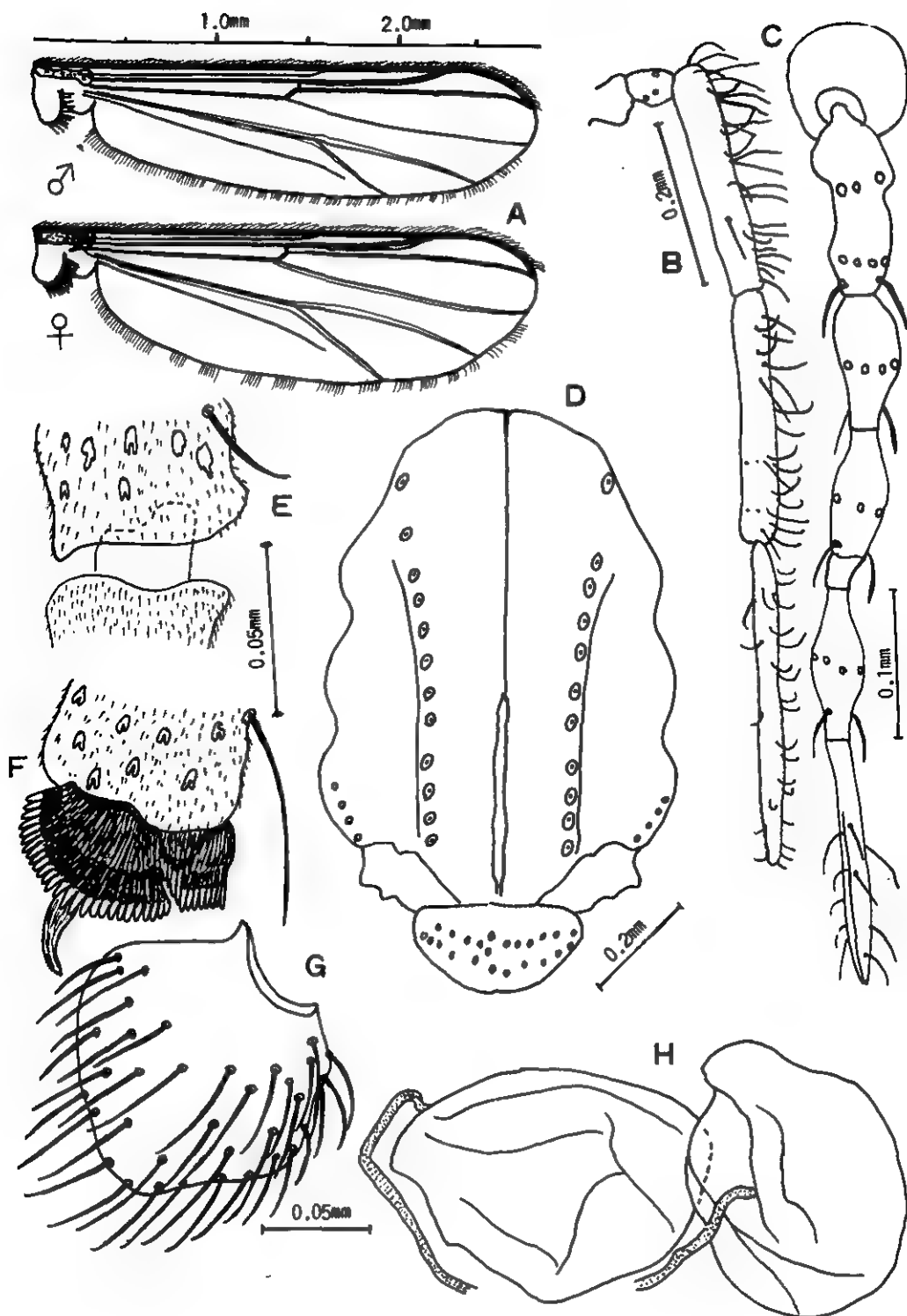


Plate 33. *Microtendipes britteni* (Edwards, 1929) Adult.

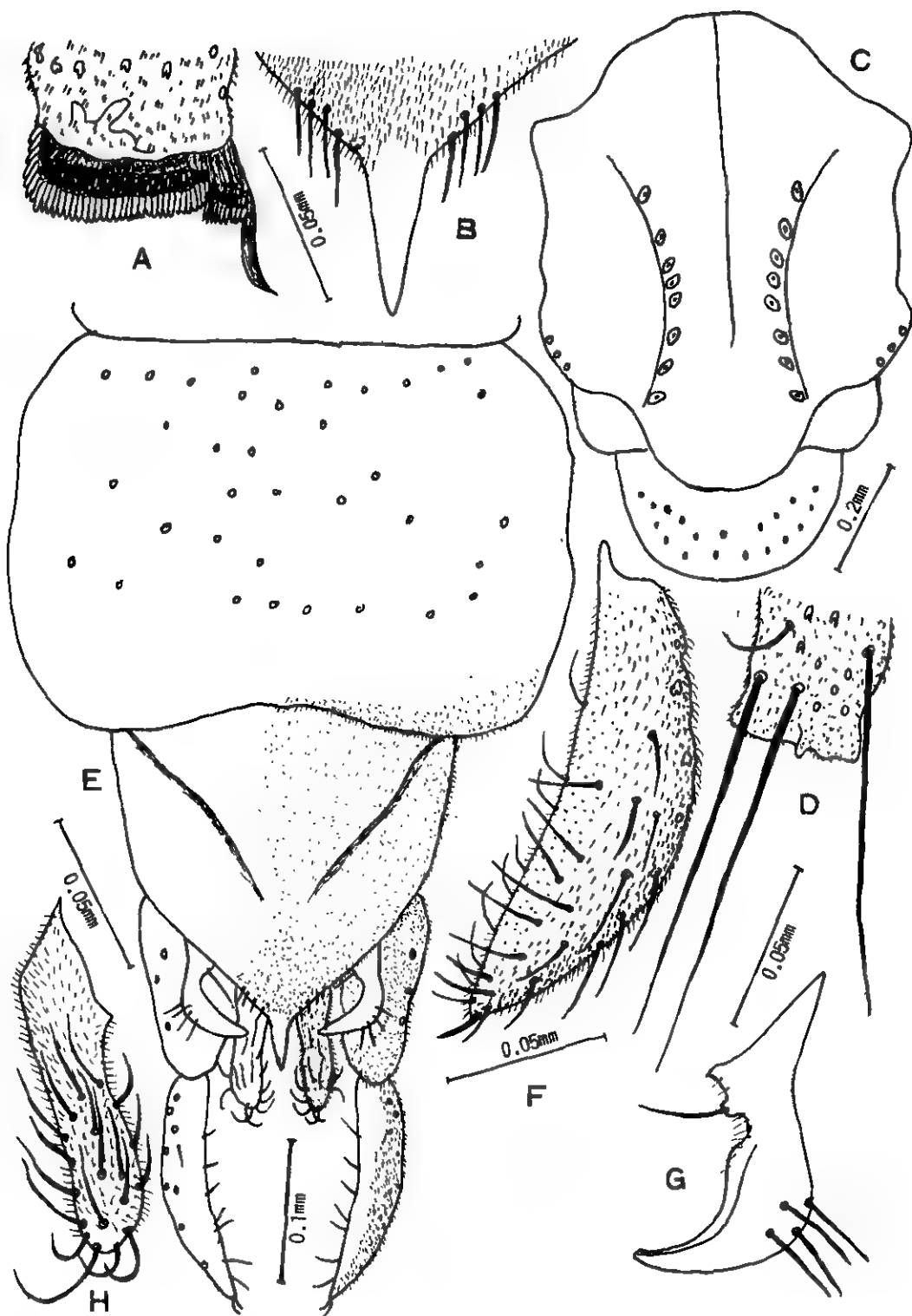


Plate 34. *Microtendipes brittini* (Edwards, 1929) Male.

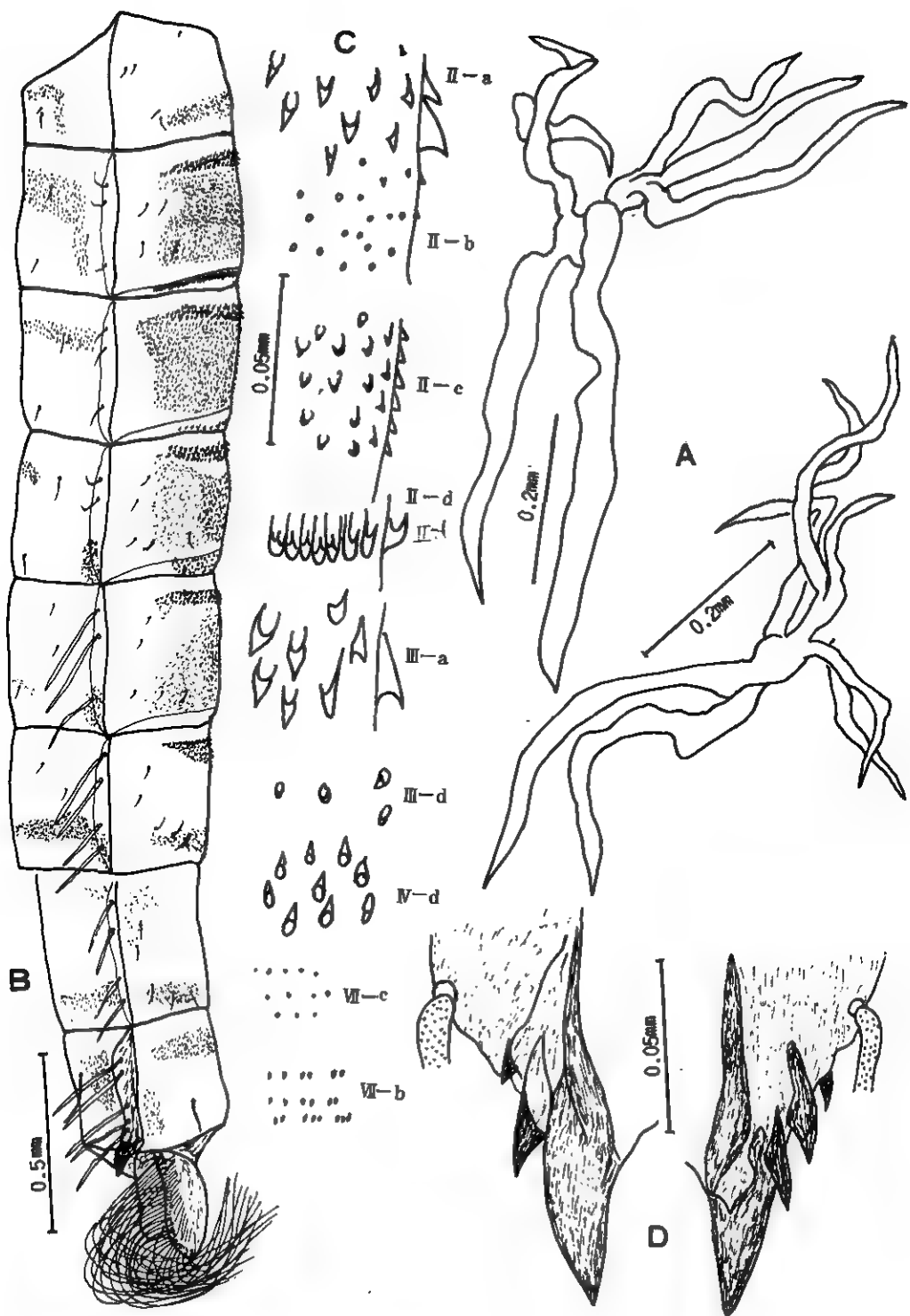


Plate 35. *Microtendipes brittini* (Edwards, 1929) Pupa.

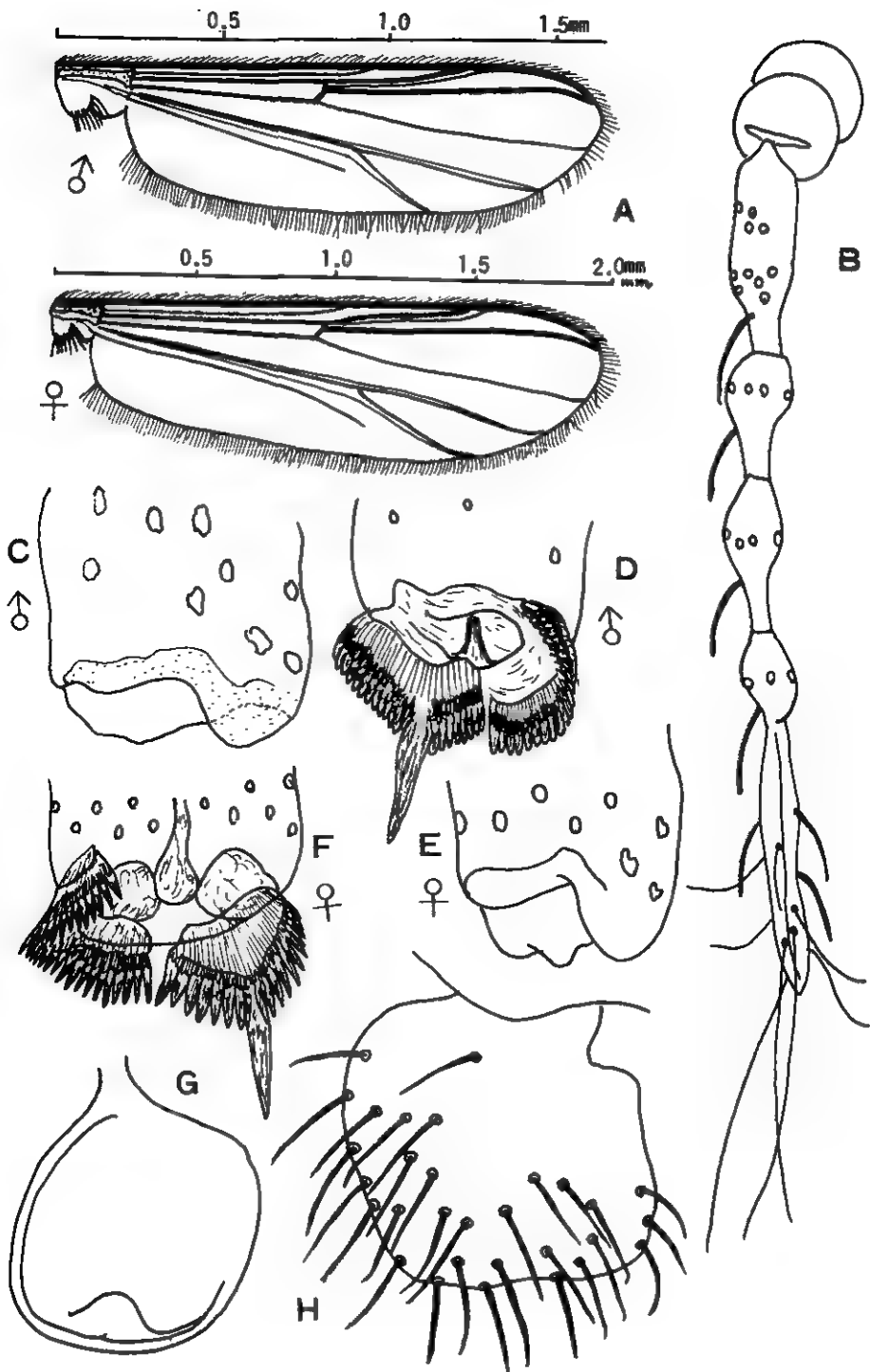


Plate 36. *Polypedilum takaoense*, sp. nov. Adult.

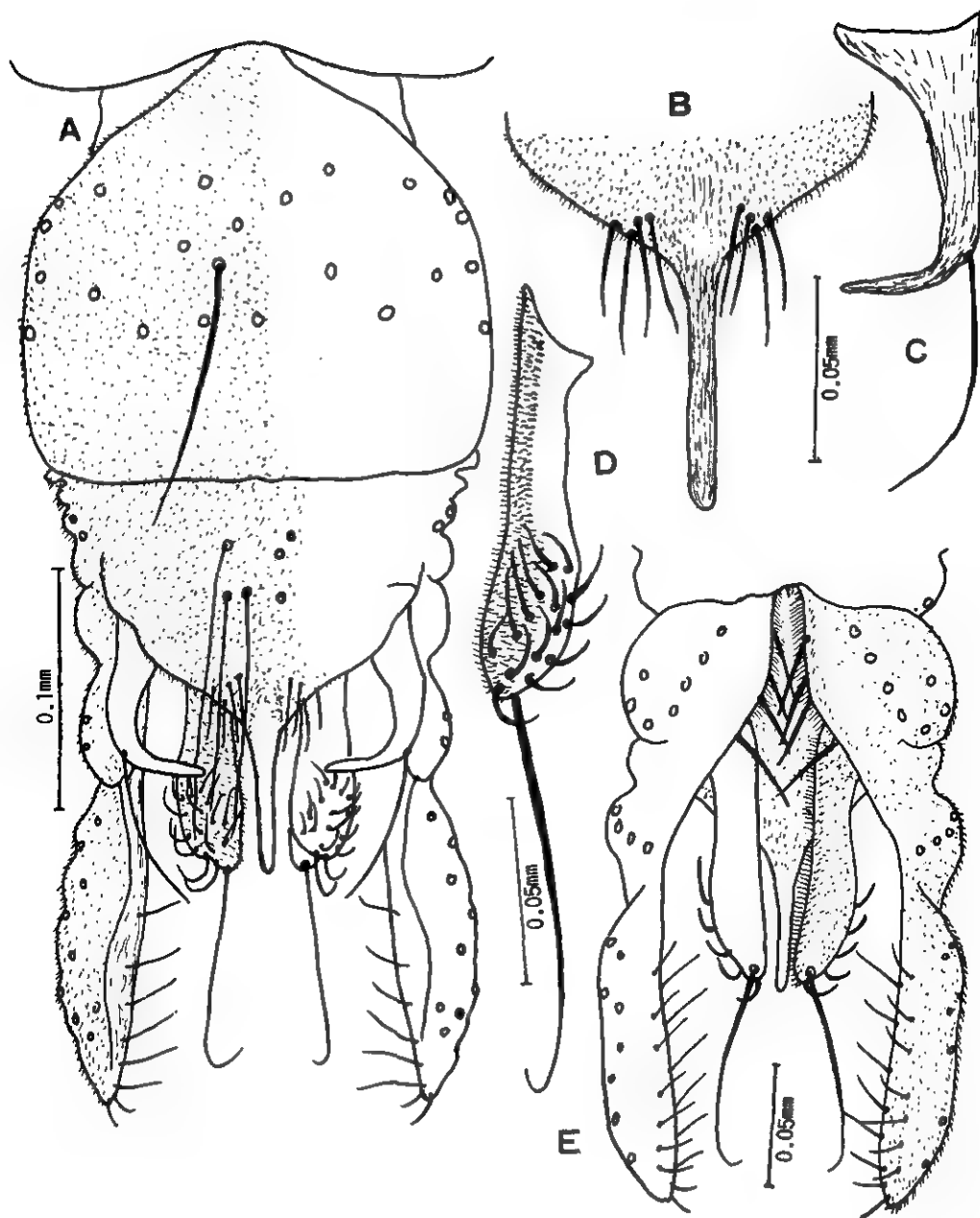


Plate 37. *Polypedilum takaoense*, sp. nov. Male.

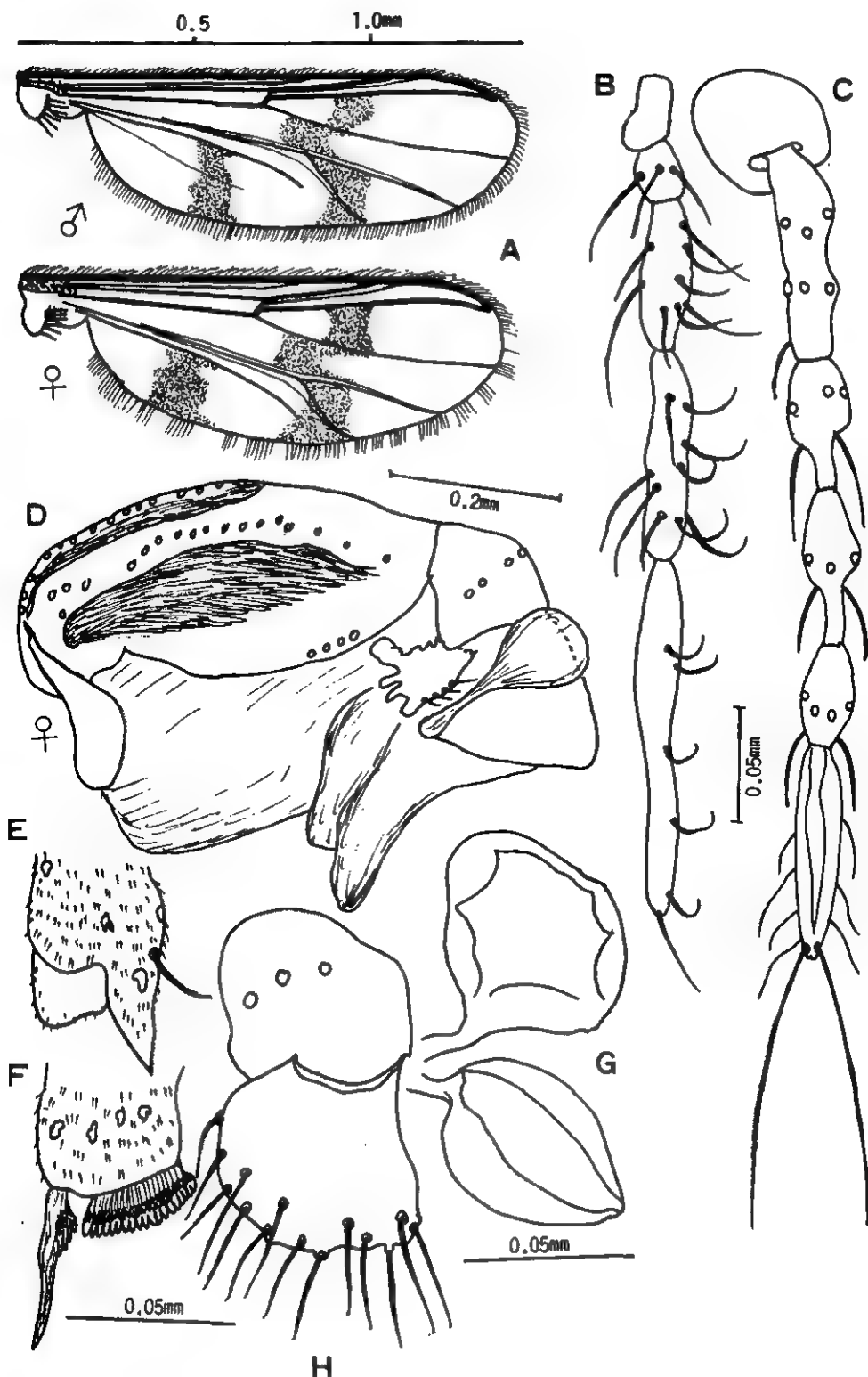


Plate 38. *Polypedilum unifascium* (Tokunaga, 1938) Adult.

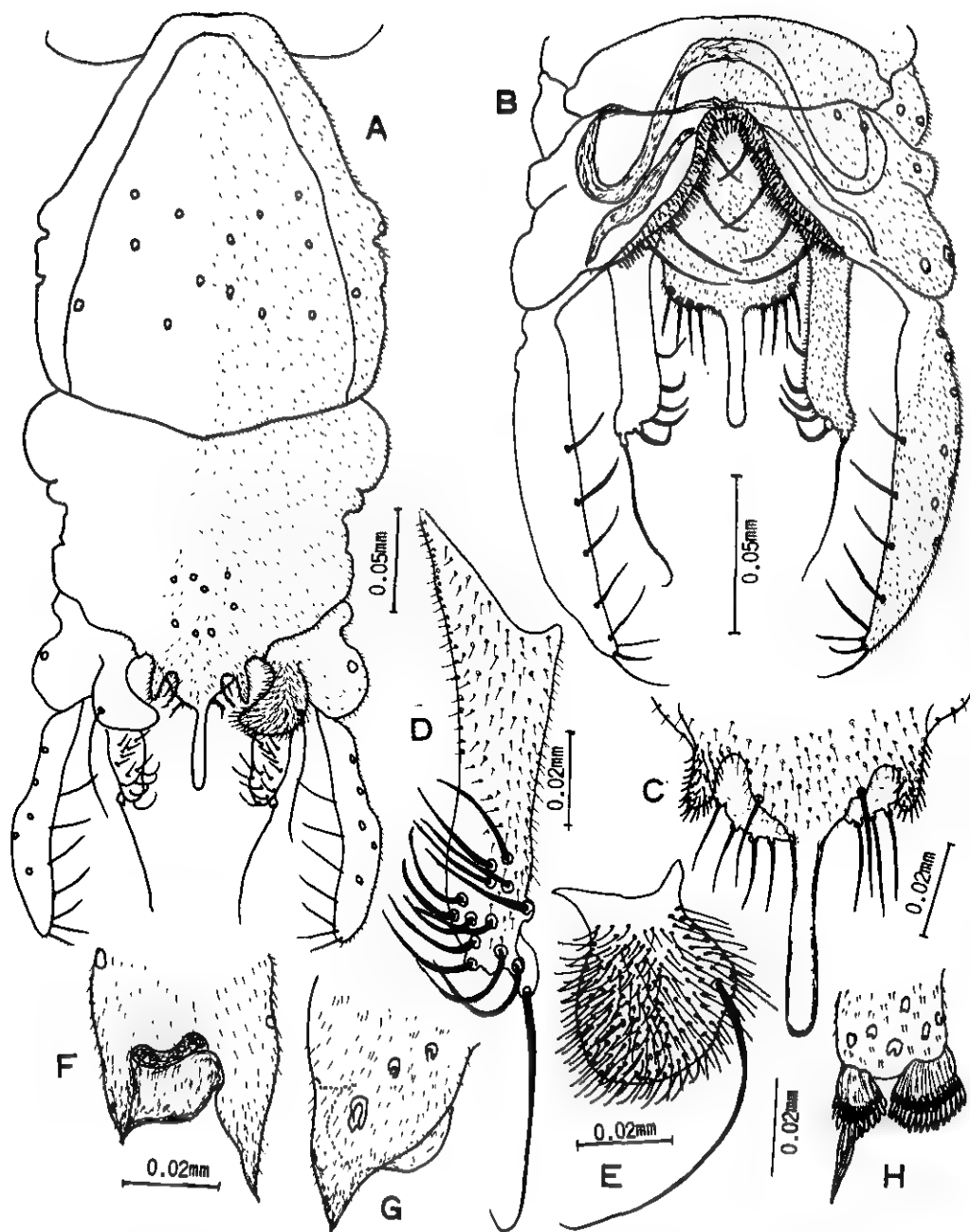


Plate 39. *Polypedilum unifascium* (Tokunaga, 1938) Male.

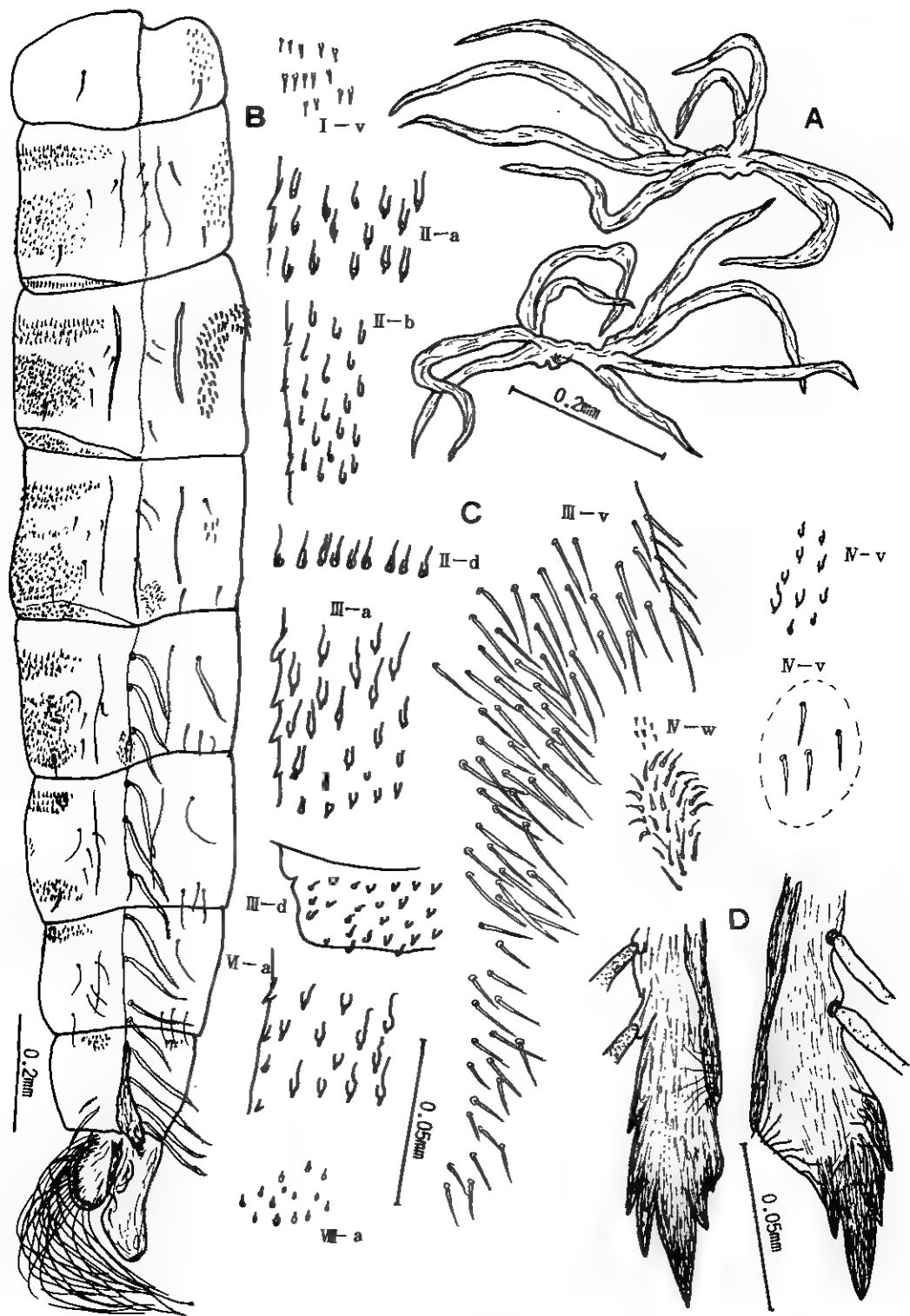


Plate 40. *Polypedilum unifascium* (Tokunaga, 1938) Pupa.

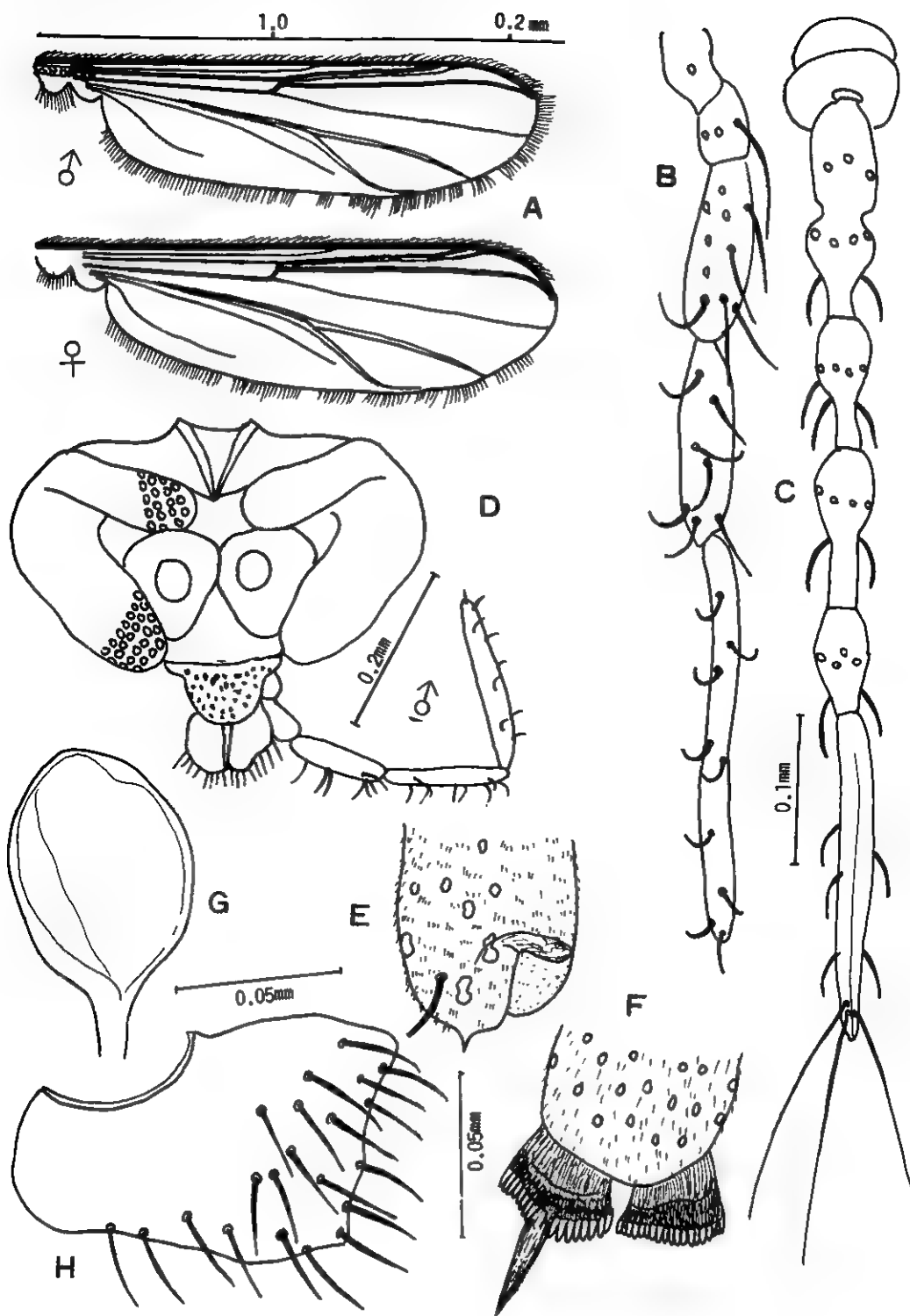


Plate 41. *Polypedilum asakawaense*, sp. nov. Adult.

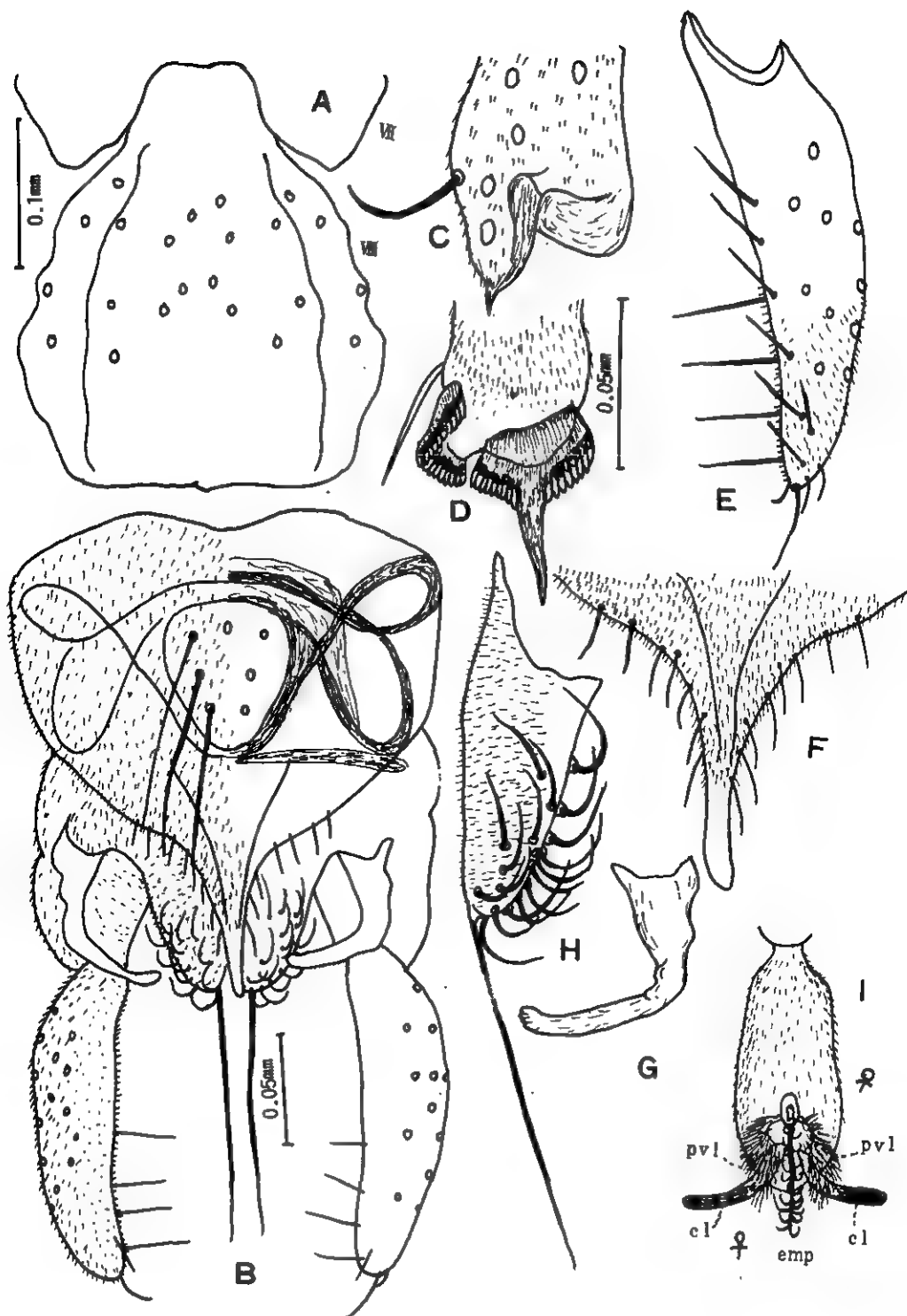


Plate 42. *Polypedilum asakawaense*, sp. nov. Adult.

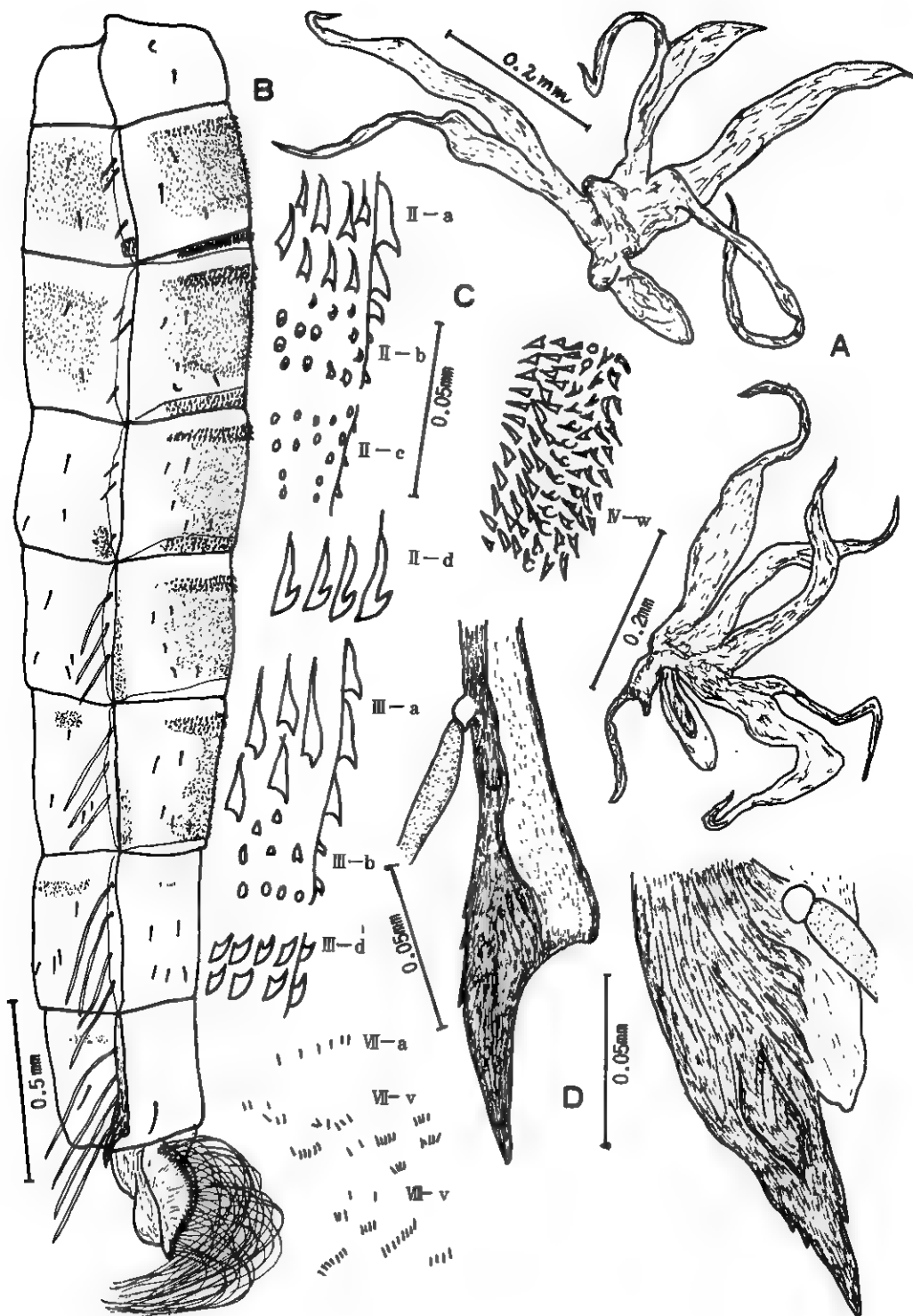


Plate 43. *Polypedilum asakawaense*, sp. nov. Pupa.

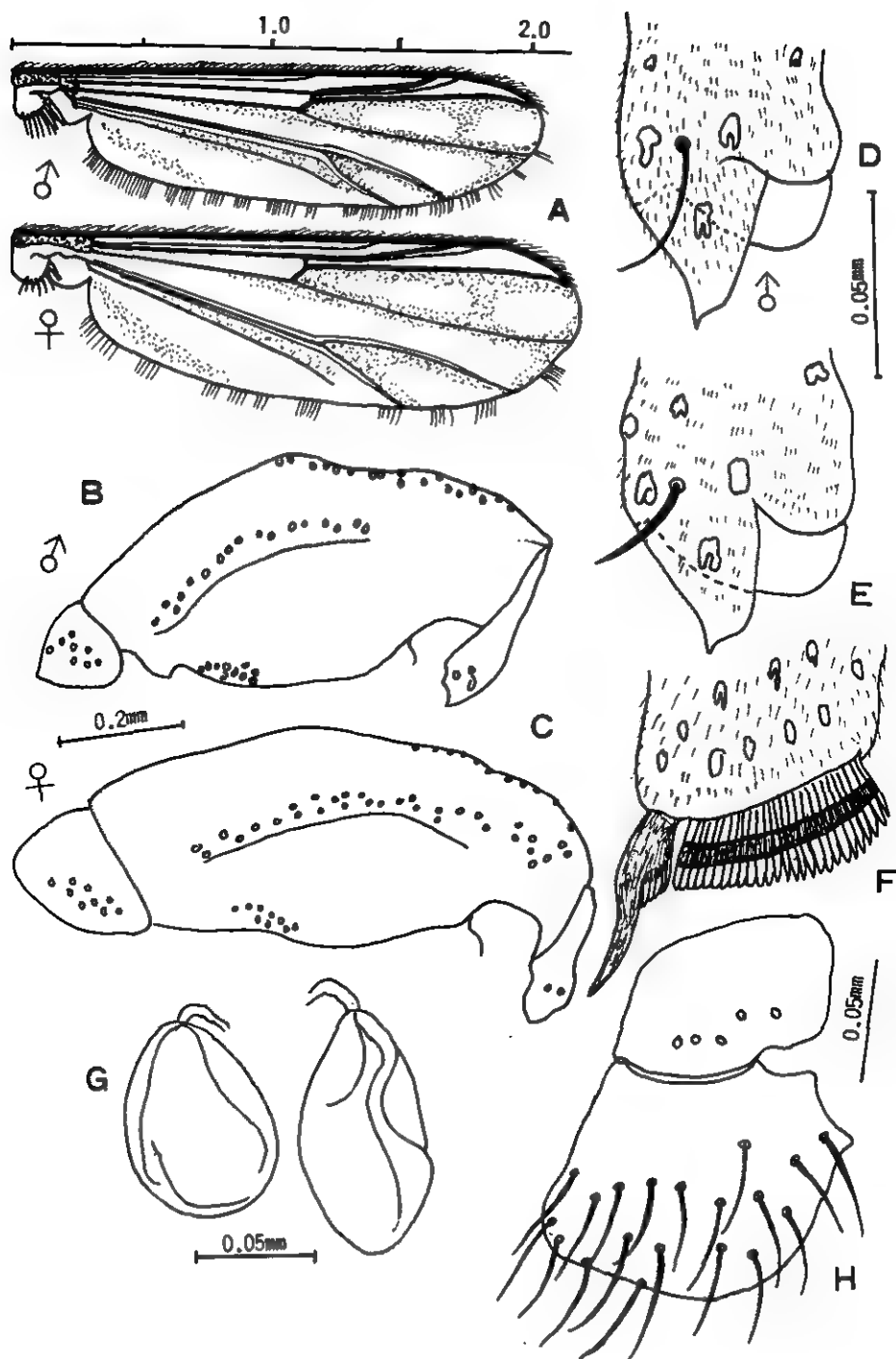


Plate 44. *Polypedilum tamagoryoense*, sp. nov. Adult.

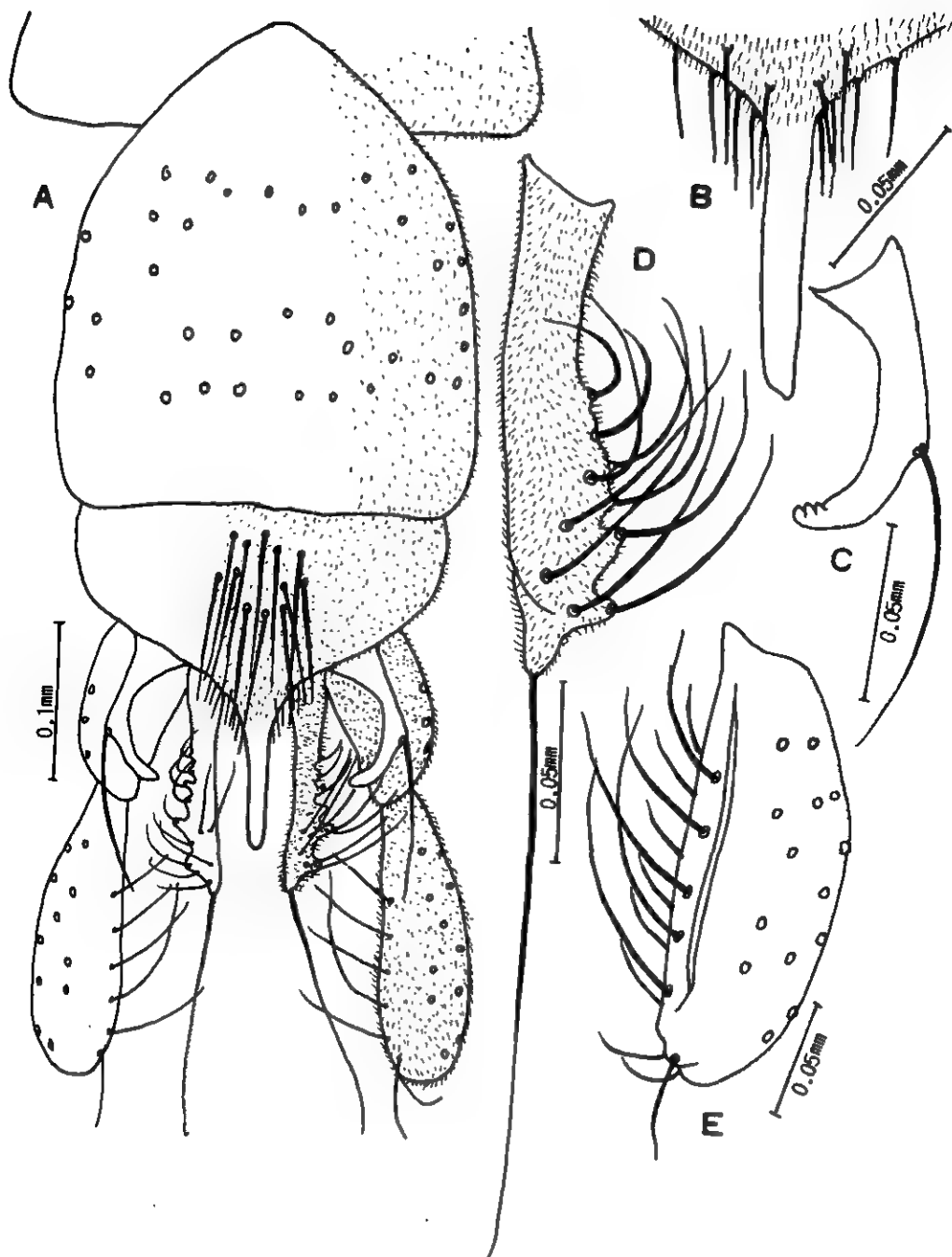


Plate 45. *Polypedilum tamagoryoense*, sp. nov. Male hypopygium.

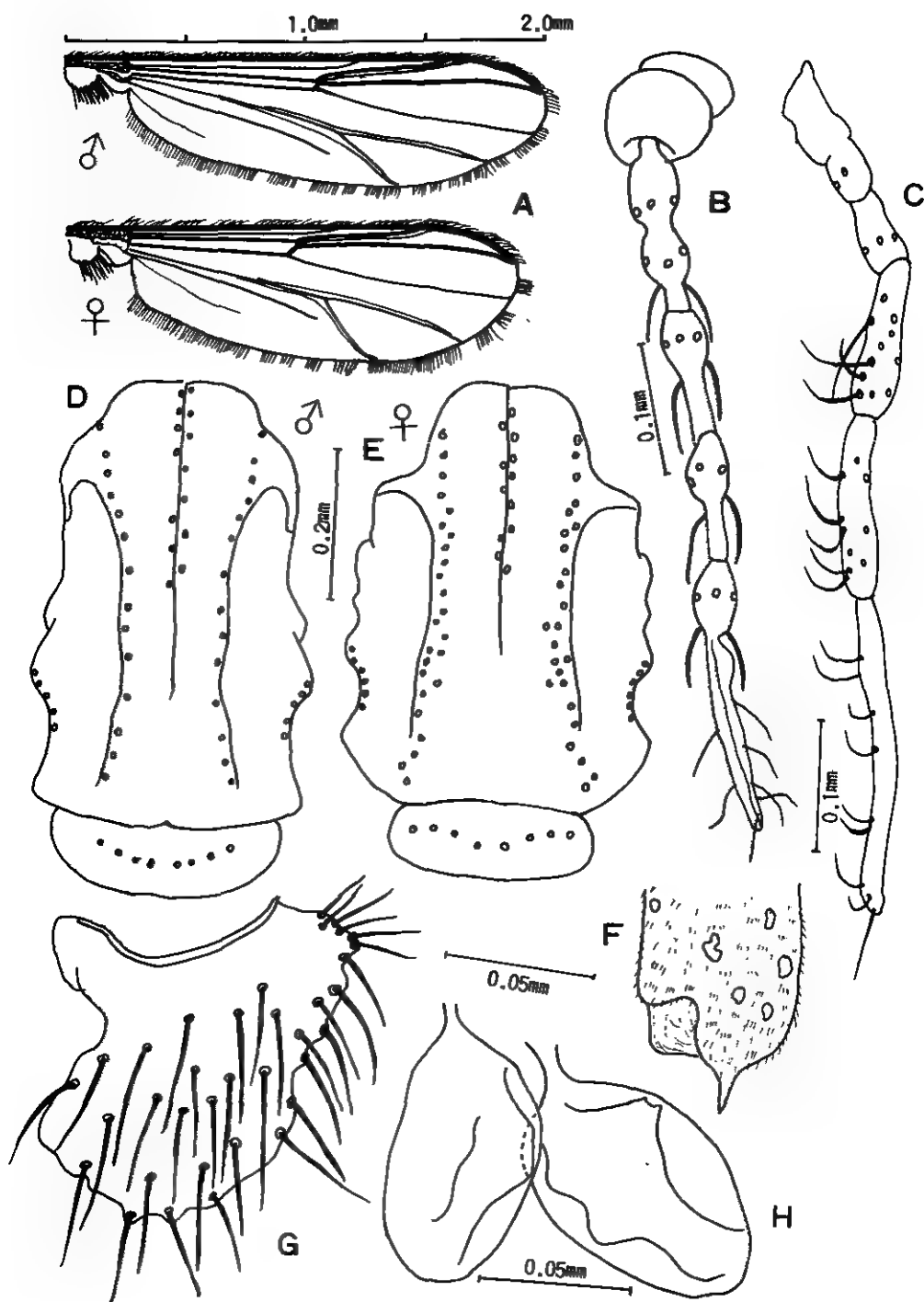


Plate 46. *Polypedilum ureshinoense* (Sasa, 1979) Adult.

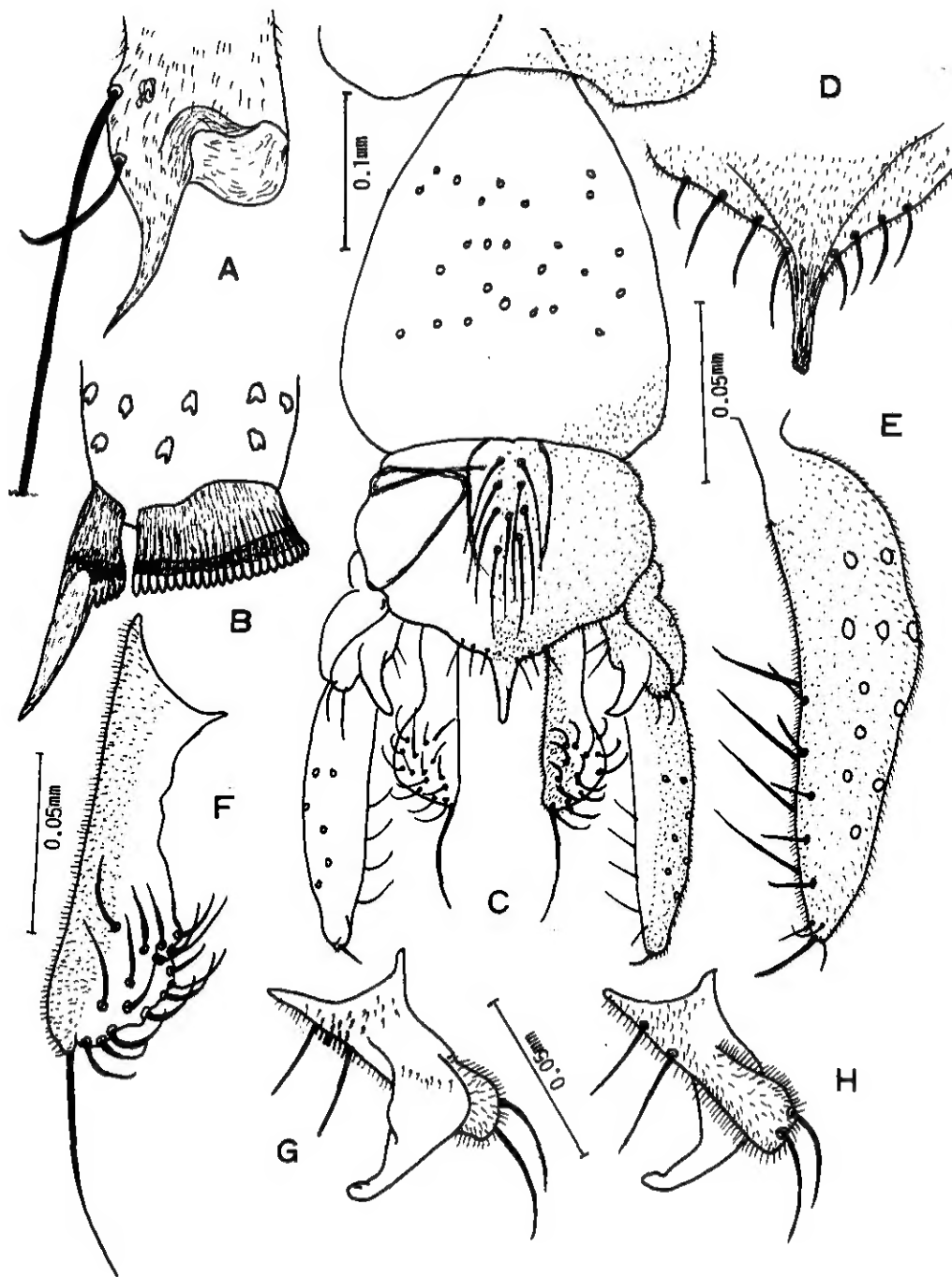


Plate 47. *Polypedilum ureshinoense* (Sasa, 1979) Male.

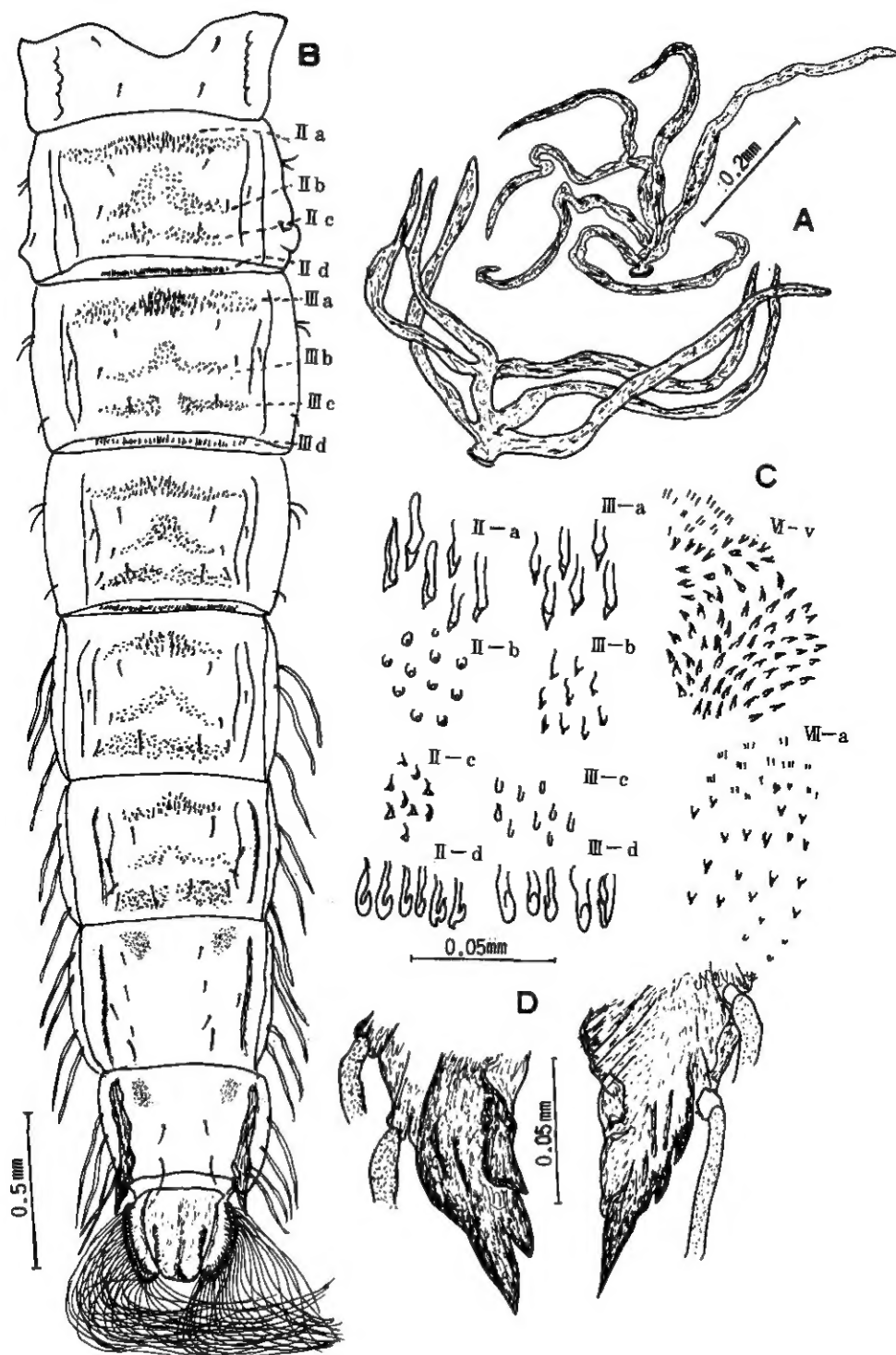


Plate 48. *Polypedilum ureshinoense* (Sasa, 1979) Pupa.

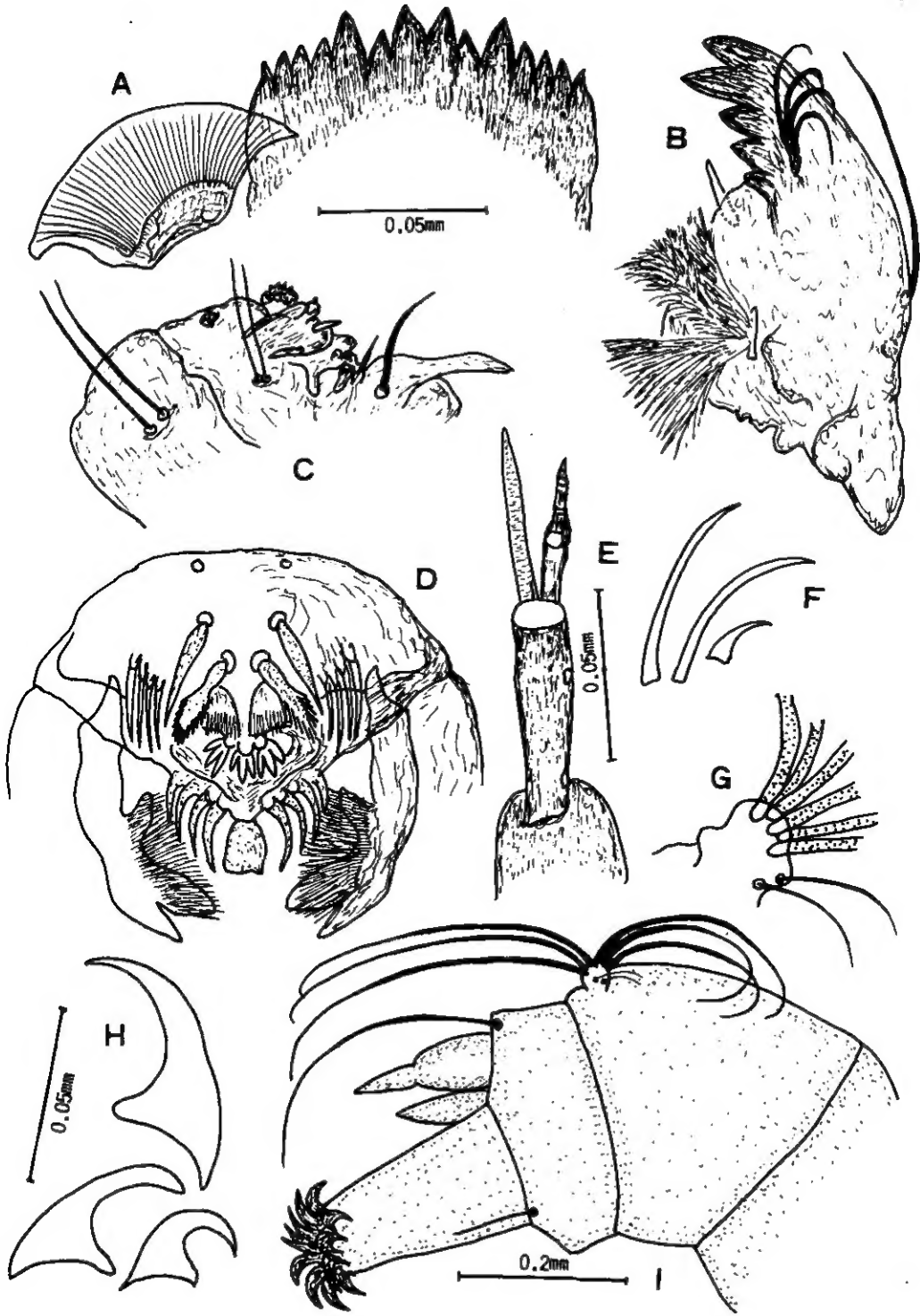


Plate 49. *Polypedilum ureshinoense* (Sasa, 1979) Larva.

多摩川に発生するユスリカの研究

第2報 その一支流に見出されたChironominae

亜科の20種について

佐々 学¹

本稿には第1報にあげたユスリカ各種のうち、Chironominae 亜科の20種について記載を行ったものである。このうち、(12) *Tanytarsus oyamai*, (19) *Chironomus kiiensis*, (20) *Chironomus yoshimatsui* の3種についてはすでに Sasa (1968, 1969) の前報に幼虫、サナギ、成虫の形態を詳述した。また (18) *Polynedilum ureshinoense* は前報では♂1, ♀1, サナギ2, 幼虫2の材料しかなかったため、今回それらが多数とれたにあたって再記載を行った。

これら20種のうち、日本以外に見出された種はわずかに (13) *Microtendipes britteni* 1種だけである。しかしそれもヨーロッパから報告されている記載とほぼ一致するからそう同定したもので、さらにくわしく比較が行いければ別種となる可能性も大きい。このように日本の河川にすむユスリカ類がヨーロッパ、アメリカ、オーストラリア、アフリカ等とほとんど共通種がないことは注目に値する。

また、従来日本の河川に発生するユスリカ類について系統的に、かつ本格的な分類学の見地から調査を行った報告はほとんどなかった。徳永雅明 (1938, 1939, 1940, 1965) がその膨大な日本産ユスリカ類の研究のなかにいくつか河川に産するユスリカ類を記録しているが、そのうちChironominae に属するもので多摩川に見出されたのは (19) *Ch. kiiensis* と (6) *Rheotanytarsus kyotoensis* の2種にすぎなかった、そこで、この20種のうち15種を新種として命名せざるをえなかったのは、驚くべきことであった。

さきに述べたように、これら各種の分布は下水の混入度と密接な相関があり、ユスリカ類を水質汚染の指標生物に利用しうる可能性が大きい。長崎県の嬉野温泉町の下水からとれた種類と南浅川が八王寺市内を流れる最も汚染度の高い部分にとれた種類とが同一の (18) *P. ureshinoense* であったことは、今後調査が進めば日本中に共通種が見出され、汚染度別の類型ができる可能性を暗示している。なお、従来は幼虫で属のいどまで判定する試みがなされているが、同じ属であっても汚染度に応じて種の分布が異なっていることが *Rheotanytarsus*, *Tanytarsus*, *Polypedilum*, *Cricotopus* などの各属で示されているから、成虫の雄を用いた厳密な分類学の手法が重要なことは明らかである。

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